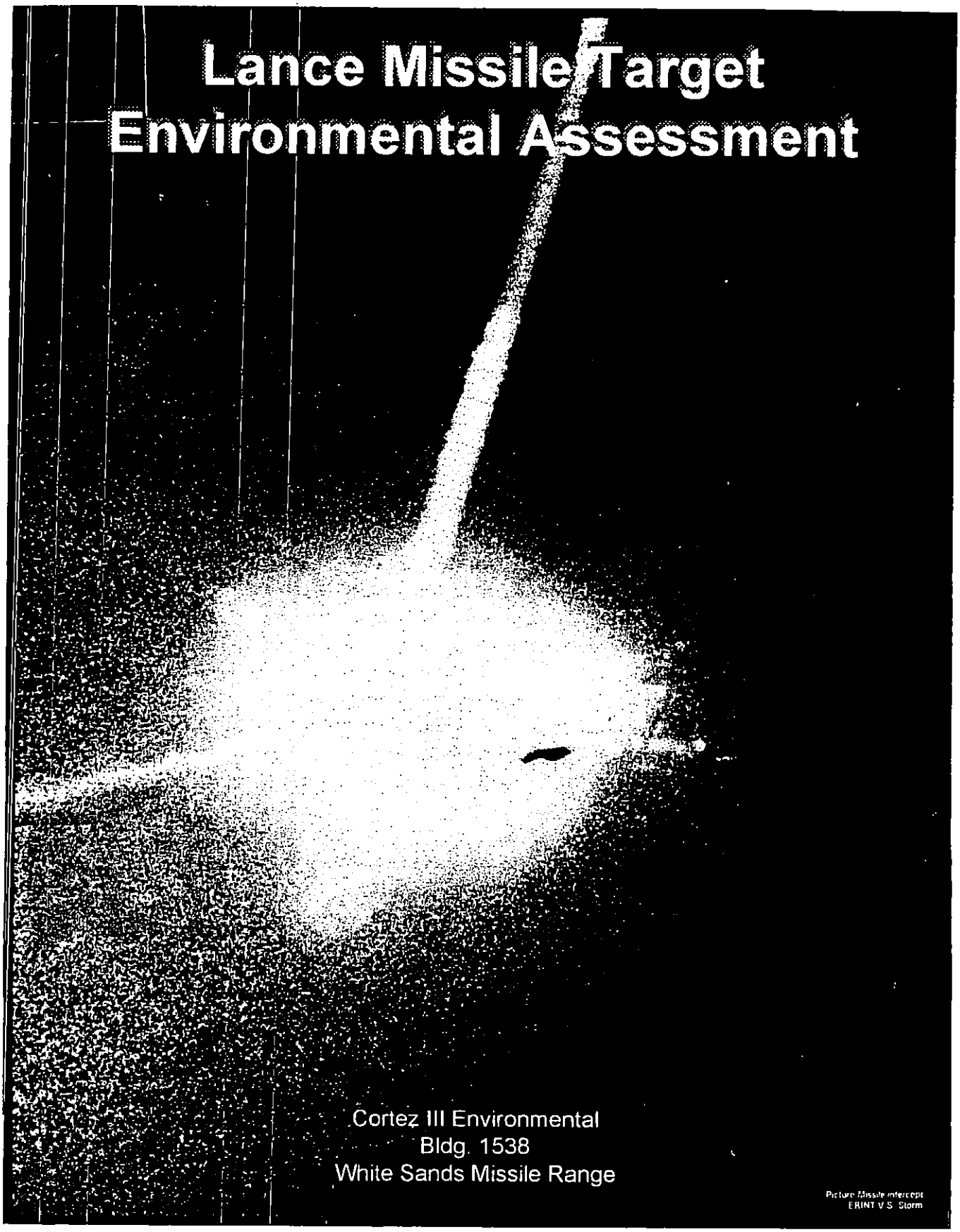
Lance Missile Target Environmental Assessment



Cortez III Environmental
Bldg. 1538
White Sands Missile Range

Picture Missile intercept
ERINT V.S. Storm

U.S. ARMY WHITE SANDS MISSILE RANGE
NEW MEXICO
FINDING OF NO SIGNIFICANT IMPACT

NAME OF PROPOSED ACTION:
Lance Missile Target Environmental Assessment

DESCRIPTION OF PROPOSED ACTION:
LANCE began flight testing in 1965 at White Sands Missile Range and was fielded in the 1970's for use by the United States and other North Atlantic Treaty Organization countries. The Lance missile system has been replaced by Army Tactical Missile System (Army TACMS) which incorporates the latest technology. Air defense missiles, which are in the development and production stages, need to test their ability to intercept targets. It is proposed that LANCE be utilized as a target for other air defense weapons.

LANCE is a single-stage, two phase, liquid bi-propellant vehicle consisting of a warhead section and an M5 missile main assembly totaling 6.13 m in length. The missile has two different payload configurations; light and heavy. LANCE when being used as a target will not carry explosive warheads except for occasions when required for mitigation purposes. The payload section will be modified to contain ballast, instrumentation, or a combination of both. LANCE travels a ballistic trajectory capable of traveling up to 130 km. LANCE is equipped with limited telemetry instrumentation.

The missile requires a solid propellant gas generator to produce a boost and sustain phase during the launch process. The liquid propellant which drives the missile during flight consists of a fuel and an oxidizer; unsymmetrical dimethylhydrazine (UDMH) and inhibited red fuming nitric acid (IRFNA), respectively.

Two types of testing will be associated with utilizing LANCE as a target; tracking and interception missions. Tracking missions consist of launching a LANCE and tracking the missile with instrumentation. Interception missions involve launching a LANCE missile and intercepting it with a missile which is presently being developed and tested. Both testing scenarios will utilize existing launch and impact areas. If the testing parameters of the tracking instrumentation or intercepting missile require the use of a non-existing launch or impact area, then additional environmental evaluations will be required, such as a Record of Environmental Consideration, prior to use.

PURPOSE OF THE PROPOSED ACTION:
Utilization of LANCE as a target allows the project to eliminate the remaining missiles (estimated at 120 missiles). This opportunity avoids the traditional disposal phase (static tests and dismantling the missile), which does not make the most efficient use of resources, and would create hazardous waste.

ALTERNATIVES CONSIDERED:
Any ballistic missile is a viable alternative to using LANCE as a target, however there are some testing scenarios for which these alternatives are not suitable based on their flight patterns, range, availability, etc.. Production of alternative targets continues unlike LANCE, therefore, the use of LANCE as targets decreases the necessary resources associated with the production of alternative targets.

Other military installations were considered for using LANCE as a target, but eliminated as possibilities for the following reasons. WSMR is where all of the developmental testing of LANCE has been conducted. All of the remaining resources and expertise for LANCE reside on WSMR. The cost of moving these resources and expertise would not be cost efficient. A majority of the projects proposing to test with LANCE as a target are presently established on WSMR. Additionally, WSMR provides both the required maximum and minimum ranges LANCE can be fired.

If LANCE is not used as a target, then remaining missiles will have to be disposed of in a potentially very costly (both monetarily and environmentally) manner. There are two steps for this alternative. First, static tests are required to eliminate as much of the fuel as possible. This requires that each missile be attached to a tower and allowed to burn its fuel. The second step is to cut open the tanks and extract the residual fuel, at which point the residual fuel and the tanks must be handled as hazardous waste. There is concern by the general public regarding the creation and storage of unnecessary hazardous waste. Propellants of this missile are more hazardous than the emissions when burned or exploded.

The no action alternative is not an option for the Lance missile system program. The missiles must be utilized or disposed.

ENVIRONMENTAL CONSEQUENCES:

Water quality and supply. LANCE is restricted from impacting missiles in areas where the ground water is in close proximity to the surface or where there is a permanent source of surface water, thus eliminating the potential of water contamination. The LANCE project does not require significant amounts of water resulting in no significant demand on the water supply.

Geology and soil. Monolithic impacts associated with utilizing LANCE as a target for a tracking test will produce a crater approximately 3 - 4.5 m wide and 2.2 - 3.6 m deep and the missile would bury itself up to 4.5 - 6 m below the surface. The crater will remain open for six months allowing the propellants to dissipate. After six months the crater will be filled and the missile will remain in place.

Air quality. Emissions will be generated by the LANCE missile, ground vehicles, and aircraft. Topographic and climatic conditions of the Tularosa and Jornada del Muerto Basins are conducive for the dissipation of emissions released by this project. The quantity of emissions released is less than the amount released by daily commuters to White Sands Missile Range. Toxic fumes of nitrogen oxides are released by the LANCE missile. Levels of NO_2 after a monolithic impact were not detectable after a 24 hour period. There will be no long term effect of these emissions as they will dissipate and continue to react and change chemical form.

Noise impact. Noise sources for the proposed action are ground vehicles, aircraft, launching the LANCE missile, and its impact. The launching of LANCE will produce the highest noise level of these sources. The area which has been determined as hazardous for humans is within 500 m of the launch area. A majority of the existing launch facilities are remotely located and the noise levels will dissipate by the time it reaches a highly populated area. Wildlife species present within 500 m will likely vacate the area due to the increased activity or will find refuge from the noise in burrows.

Fish and wildlife. Use of the Pup Weapons Impact Target (WIT) is not permitted by this project, as Salt Creek dissects the WIT. The use of other existing facilities will not significantly impact the wildlife of the area. Generally, wildlife species around these areas are either acclimated to the increased activity or have vacated the areas. There is potential for killing individuals which may be present within impact areas. The loss of a few individuals of wildlife species that commonly inhabit impact areas will not adversely significantly effect their entire populations.

Threatened and endangered species. LANCE will utilize existing launch and impact areas . Launch areas are generally cleared of all vegetation and either covered with a layer of base coarse gravel or are left barren. Impact areas are maintained in nearly bare ground to bare ground conditions for the purpose of data collection and debris recovery. Plant species which reoccur under these conditions are early seral stage plants. Most listed species are mid to late seral stage plants.

Avoidance of Pup WIT eliminated any potential for this project to effect the White Sands pupfish. A loss of a few Texas horned lizards utilizing the impact areas may die as a result of the actions of this project.

Prior to the use of areas outside of existing launch and impact areas, a survey for listed plant and wildlife taxa will be conducted.

Cultural resources. Existing launch and impact areas will be utilized whenever possible. If unestablished areas are required for test activities archeological surveys will be conducted. A report presenting the results will be delivered to DES-E one month prior to use.

CONCLUSIONS: The proposed action would not significantly affect the environmental conditions that exist at WSMR. Any potential threats have been mitigated.

Based on the considerations contained herein and the foregoing conclusions, an Environmental Impact Statement is not required. This Finding of No Significant Impact is hereby submitted for the proposed action.

POINT OF CONTACT: An environmental document that supports a "Finding of No Significant Impact" is available for public reading at the following locations: The WSMR Environmental Services Division, Building T-150, WSMR; WSMR Visitor Center (Public Affairs), Building 122, WSMR; and the Public Library where this notice was published. All are invited to submit written comments for consideration by the Commander, WSMR, within 30 days of the notice. Address all correspondence to:

Commander
U.S. Army White Sands Missile Range
ATTN. STEWS-DES-E
White Sands Missile Range, NM 88002-5048

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EXECUTIVE SUMMARY

LANCE began flight testing in 1965 at White Sands Missile Range and was fielded in the 1970's for use by the United States and other North Atlantic Treaty Organization countries. The Lance missile system has been replaced by Army Tactical Missile System (Army TACMS) which incorporates the latest technology. Air defense missiles, which are in the development and production stages, need to test their ability to intercept targets. It is proposed that LANCE be utilized as a target for other air defense weapons.

LANCE is a single-stage, two phase, liquid bi-propellant vehicle consisting of a warhead section and an M5 missile main assembly totaling 6.13 m in length. The missile has two different payload configurations; light and heavy. LANCE will not carry explosive warheads when being used as a target. The payload section will be modified to contain ballast, instrumentation, or a combination of both. LANCE travels a ballistic trajectory capable of traveling up to 130 km. LANCE is equipped with limited telemetry instrumentation.

The missile requires a solid propellant gas generator to produce a boost and sustain phase during the launch process. The liquid propellant which drives the missile during flight consists of a fuel and an oxidizer; unsymmetrical dimethylhydrazine (UDMH) and inhibited red fuming nitric acid (IRFNA), respectively.

Two types of testing will be associated with utilizing LANCE as a target; tracking and interception missions. Tracking missions consist of launching a LANCE and tracking the missile with instrumentation. Interception missions involve launching a LANCE missile and intercepting it with a missile which is presently being developed and tested. Both testing scenarios will utilize exiting launch and impact areas. If the testing parameters of the tracking instrumentation or intercepting missile require the use of a non-existing launch or impact area, then additional environmental evaluations will be required, such as a Record of Environmental Consideration, prior to use.

Utilization of LANCE as targets allows the project to eliminate the remaining missiles (estimated at 120 missiles). This opportunity avoids the traditional disposal phase (static tests and dismantling the missile) which does not make the most efficient use of resources and would create hazardous waste.

Any ballistic missile is a viable alternative to using LANCE as a target, however there are some testing scenarios for which these alternatives are not suitable based on their flight patterns, range, availability, etc. Production of alternative targets continues unlike LANCE, therefore, the use of LANCE as targets decreases the necessary resources.

If LANCE is not used as a target, then remaining missiles will have to be disposed of in a potentially very costly (both monetarily and environmentally) manner. There are two steps for this alternative. First, static tests are required to eliminate as much of the fuel as possible. The second step is to cut open the tanks and extract the residual fuel, at which point the residual fuel and the tanks must be handled as hazardous waste. There is concern by the general public regarding the creation and storage of unnecessary hazardous waste. The unused propellants of this missile are more hazardous than the emissions when burned or exploded.

The no action alternative is not an option for the Lance missile system program. The missiles must be utilized or disposed.

Potential environmental consequences are briefly discussed below.

Monolithic impacts in hydrologically sensitive areas (i.e. ABC-1, Denver, and Rhodes WIT) could potentially pollute the ground water with residual liquid propellents where the water table is shallow. For this reason, these areas have been restricted from use for monolithic impacts. These areas can be utilized only if the LANCE missile is equipped with either a device which will cause the missile to become unstable prior to impact (resulting in a surface impact), or if the missile is made to explode on impact burning all residual fuel.

LANCE will not use Pup WIT as an impact area to any extent. The hazards associated with the chemicals which fuel LANCE are potentially damaging to the White Sands pupfish or their habitat. Therefore, to prevent a "may affect" situation the area will be avoided.

Described test activities will not place an extreme demand on the domestic water supply.

Monolithic impacts associated with utilizing LANCE as a target for a tracking test will produce a crater approximately 3 - 4.5 m wide and 2.2 - 3.6 m deep and the missile would bury itself up to 4.5 - 6 m below the surface. The crater will remain open for six months allowing the propellants to dissipate. After six months, the crater will be filled and the missile will remain in place. Equipment used to fill the crater is generally a backhoe or armor plated grader. Soil which was forced out of the ground upon impact is used to fill the hole. If additional soil is required it is obtained from mounds located within the WIT. Off road vehicle use has been restricted to recovery operations when deemed necessary to reduce the potential of soil erosion. Drip pans are required wherever generators are used to mitigate potential soil contamination associated with fueling operations.

Vegetation may be slightly altered by LANCE. Efforts to minimize the effect include, having fire support on standby and limiting offroad vehicle use. LANCE will utilize existing launch and impact areas. Launch areas are generally cleared of all vegetation and either covered with a layer of base coarse gravel or are left barren. Impact areas are maintained in nearly bare ground to bare ground conditions for the purpose of data collection and debris recovery. The possibility for listed threatened and endangered species to occur within these areas is very remote. Prior to the use of areas outside of existing launch and impact areas, a survey for listed plant and animal taxa will be conducted.

Faunal communities also have the potential to be effected by LANCE. Only those animals within the immediate area have the potential to be destroyed by direct impact or by contact of residual UDMH. Wildlife species around these areas are either acclimated to the increased activity or have vacated the areas. Loss of a few individuals of wildlife species, that commonly inhabit impact areas, will not effect their entire populations. Potential for threatened or endangered species occurring within these areas is remote.

Noise sources that could have a potential impact are those associated with launch

process. A majority of the existing launch facilities are remotely located and the noise levels will not be significant by the time it reaches a highly populated area. Wildlife species present within 500 m will likely vacate the area due to the increased activity or will find refuge from the noise in burrows.

Emissions created by missiles, radar equipment, and ground vehicles will be released into the atmosphere. The quantity released is not significant when compared to yearly estimates for emissions created by daily commuters to WSMR. Released emissions will quickly dissipate due to favorable climatic and topographic features associated with WSMR thus reducing the potential for any adverse impact.

Activities associated with using LANCE as targets will not alter the climate of the area.

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1.0 PROJECT DESCRIPTION

1.1 Background and Previous Environmental Documentation Review

This Environmental Assessment (EA) evaluates the potential environmental impacts of using the Lance missile as a target for other air defense missiles. The Lance missile (LANCE) has proceeded through the engineering development, operational, and stockpile surveillance phases as according to its life cycle EA and addendum (U. S. Army 1989a and U. S. Army 1989b).

LANCE began flight testing in 1965 and was fielded in the 1970's for use by the United States and other North Atlantic Treaty Organization countries. White Sands Missile Range (WSMR) has been home for the majority of LANCE testing. Many of the resources at WSMR utilized by LANCE were developed for Honest John and other rocket programs. These sites date back to the 1940's and included Launch Complex 33 (LC 33), Stallion Weapons Impact Target (WIT) and other remote sites. These areas are now used by more sophisticated and advanced weapon systems (Multiple Launch Rocket System and Army Tactical Missile System, as well as other mobile testing groups). The stockpile and surveillance phase of LANCE required annual service practice test to assure that troops assigned to LANCE battalions were still proficient in the use of this missile. Data gathered during tests were used to assure the operational readiness of LANCE.

Additional environmental documentation associated with LANCE include an Environmental Assessment (U.S. Army 1989a), an addendum to the EA (U.S. Army 1989b), a propellant study conducted by the project (Wilson 1991), and several Records of Environmental Consideration (REC). The propellant study was conducted to evaluate the environmental effect of previous LANCE testing, specifically effects of the fuel and oxidizer, on the soil system. A copy of this study is provided in Appendix A. Previous RECs were written to address minor changes, such as use of existing launch and impact areas, in the proposed actions presented in existing EAs.

1.2 Purpose and Need

The Lance missile system has been replaced by Army Tactical Missile System (Army TACMS) which incorporates the latest technology. However, LANCE can still play a critical role in advancing the air defense missile technology. Air defense missiles, which are in the development and production stages, need to test their abilities of intercepting targets. It is proposed that LANCE be utilized as a target for other air defense weapons.

LANCE travels a ballistic trajectory similar to missiles which may be used by less developed countries, therefore creating a realistic target. Utilization of LANCE as a targets will eliminate the remaining missiles (estimated at 120 missiles). This opportunity avoids the traditional disposal phase (static tests and dismantling the missile) which does not make the most efficient use of resources allocated to the missile and would create hazardous waste.

1.3 Alternatives

Cruise missiles, HERA, Patriot missiles, drones, and basically any ballistic missile may be utilized as targets for various air defense missile programs. These targets are viable alternatives to using LANCE as a target, however there are some testing scenarios for which these alternatives are not suitable based on their flight patterns, range, availability, etc.. Production of alternative targets continues unlike LANCE, therefore, the use of any of these alternatives would necessitate additional resources. LANCE as targets decreases the necessary resources and hazards associated with the disposal phase.

Other military installations were considered for using LANCE as a target, but eliminated as possibilities for the following reasons. WSMR is where all of the developmental testing of LANCE has been conducted. All of the remaining resources and expertise for LANCE reside on WSMR. Relocating these resources and expertise would not be cost efficient. A majority of the projects proposing to test with LANCE as a target are presently established on WSMR. Additionally, WSMR provides both the required maximum and minimum ranges LANCE can be fired.

If LANCE is not used as a target, then remaining missiles will have to be disposed of in a potentially very costly (both monetarily and environmentally) manner. There are two steps for this alternative. First, static tests are required to eliminate as much of the fuel as possible. This requires that each missile be attached to a tower and allowed to burn its fuel. The second step is to cut open the tanks and extract the residual fuel, at which point the residual fuel and the tanks must be handled as hazardous waste. There is concern by the general public regarding the creation and storage of unnecessary hazardous waste. Propellants of this missile are more hazardous in the form of fuel than the emissions when the fuel is burned or explodes (explained in greater detail in section 1.4.2).

The no action alternative is not an option for the Lance missile system program. The missiles must be disposed of in some manner.

1.4 Description of LANCE

1.4.1 General

LANCE is a single-stage, two phase, liquid bi-propellant vehicle consisting of a warhead section and an M5 missile main assembly (Figure 1). LANCE is a total of 6.13 m in length.

The missile has two different payload configurations; light and heavy. LANCE will not carry explosive warheads when being used as a target. The payload section will be modified to contain ballast, instrumentation, or a combination of both. Approximate weights for the light and heavy configurations are 213 kg and 454 kg, respectively. LANCE travels a ballistic trajectory capable of traveling up to 130 km. LANCE is equipped with limited telemetry instrumentation.

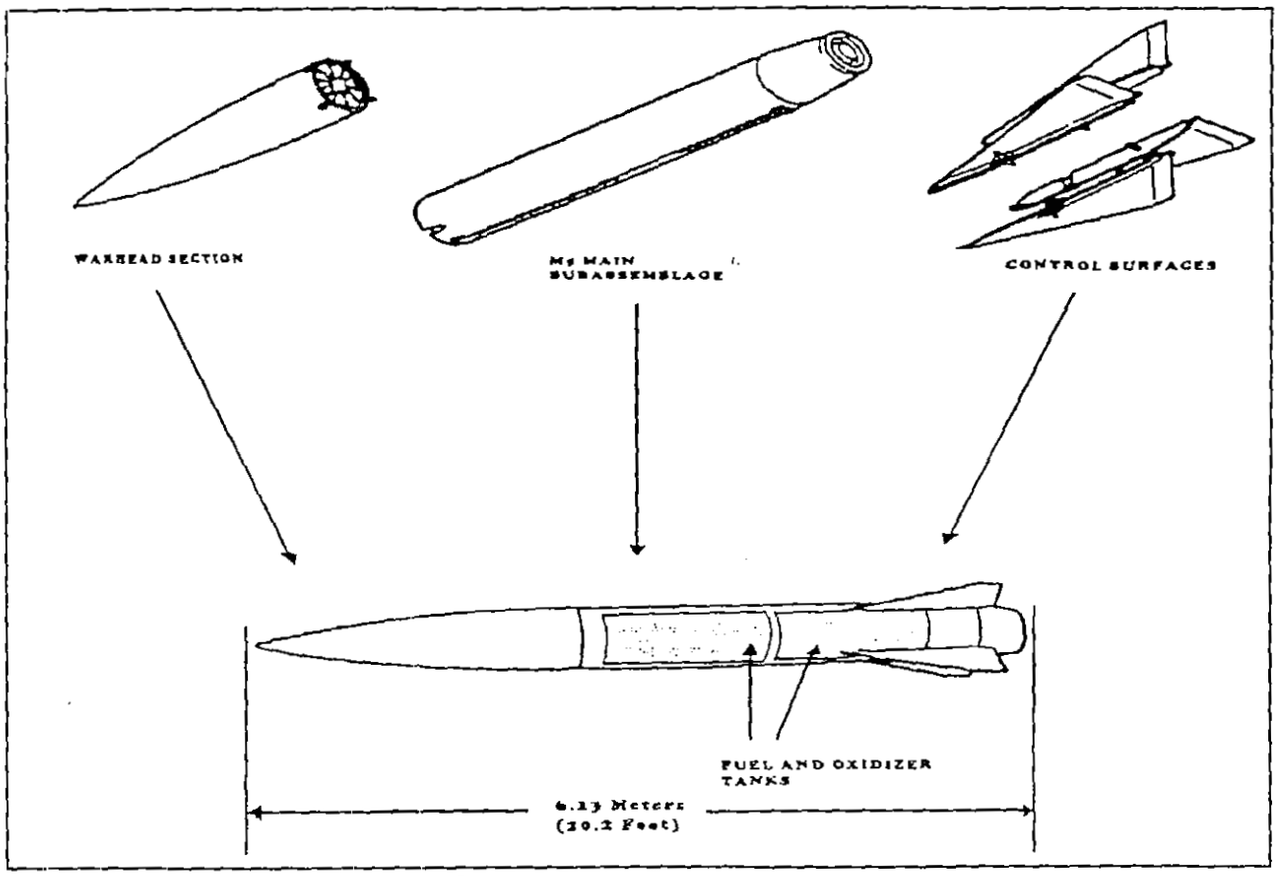

Figure 1. Diagram of the LANCE.

LANCE can be launched from and transported by a tracked self propelled vehicle or a special trailer. The tracked self propelled vehicle allows access to areas across rough terrain or down improved roads. The light weight launcher can be towed by a vehicle or air lifted by helicopter.

1.4.2 Propulsion System

The missile requires a solid propellant gas generator (SPGG) to produce a boost and sustain phase during the launch process. SPGG is composed of a double-based material: nitrocellulose (20.8% nitroglycerin) and sustainer grains. The boost phase is generated by exposing the maximum amount of grain surface to hot gases from an ignitor. This rapid initial pressure buildup lasts for approximately 5 seconds and is referred to as the boost phase. The sustain phase is created by a propagating wave produced by the boost phase. This phase results in the pressurization for the controlled propellant explosion needed during the sustain phase of flight. The amount of solid propellant required per flight is 46 pounds (20.9 kg). Products produced during combustion are located in Table 1.

Table 1 . SPGG Combustion Products		
Product	Chemical Symbol	Grams of products of combustion per 100 grams of propellant
Carbon	C	8.99
Carbon Monoxide	CO	32.53
Carbon Dioxide	CO_2	35.13
Hydrogen	H	3.16
Water	H_2O	8.56
Nitrogen	N_2	11.49

The liquid propellant consists of a fuel and an oxidizer; unsymmetrical dimethylhydrazine (UDMH) and inhibited red fuming nitric acid (IRFNA), respectively. These liquids are isolated within two end to end cylindrical aluminum tanks, which are sealed with high pressure seals along the propellant feedlines. The fuel (UDMH) is located in the forward tank and the oxidizer (IRFNA) in the aft tank.

Unsymmetrical dimethylhydrazine (UDMH) is a clear, colorless liquid which is hygroscopic (capable of absorbing moisture from the air). This liquid has a sharp ammonia or fishy odor and produces clear and colorless fumes. The material safety data sheet for this chemical is included in Appendix B. Basically, this material is highly explosive (lower and upper explosive limits: 2% and 95%, respectively) and reacts vigorously with heat, sparks, open flames, strong oxidizers, and air. Emission products related with burning UDMH include two hazardous components; carbon monoxide and oxides of nitrogen. Associated fires can be extinguished with carbon dioxide, dry chemicals and water spray.

Inhibited red fuming nitric acid (IRFNA) is a brown liquid which has a pungent or acrid odor and produces reddish-brown to orange fumes. The material safety data sheet for this chemical is provided in Appendix B. This chemical is not explosive and considered stable. However, violent spattering and considerable heat is generated when this chemical is exposed to water. Nitrogen oxide vapors are released during reactions with water, which are toxic and flammable.

The amount of UDMH and IRFNA required for a single missile is 170 kg and 502 kg, respectively. Three factors greatly influence the amount of fuel burned during a flight; range of the missile, payload weight, and wind conditions. The farther the missile travels, the greater the amount of fuel expended. There are potentially two different configurations which may be used during a test; light and heavy. The heavier the payload, the greater the amount of fuel required for travel. Table 2 and 3 present the amounts of propellants burned and residuals for light and heavy configurations for a variety of distances. Combustion products and amounts of these propellants are presented in Table 4.

Table 2 . Propellants burned and residuals for the light missile configuration in respect to distance traveled.				
	Propellant Burned (kg)		Residuals (kg)	
Distance missile traveled (km)	IRFNA	UDMH	IRFNA	UDMH
10	159	47	343	123
30	350	108	152	62
60	462	144	40	26
100	483	152	18	19
115	484	156	18	14
120	480	154	22	16
125	484	157	18	16
130	488	158	14	14

Table 3. Propellants burned and residuals for the heavy missile configuration in respect to distance traveled.				
	Propellant Burned (kg)		Residuals (kg)	
Distance missile traveled (km)	IRFNA	UDMH	IRFNA	UDMH
10	180	55	322	115
25	344	106	158	65
42	443	137	59	33
60	457	143	45	27
75	475	150	27	20
91	490	156	12	14

Table 4. Combustion Products of IRFNA and UDMH		
Product	Symbol	Grams of Products of Combustion Per 100 grams of Propellant
Water	H_2O	37.27
Hydrogen	H	0.38
Nitrogen	N	28.64
Hydrogen Fluoride	HF	0.52
Carbon Dioxide	CO_2	27.02
Carbon Monoxide	CO	6.10

LANCE will be delivered to WSMR in a wooden round configuration, which means it will arrive at WSMR fueled and ready for use. No modifications to the missile other than the selection of payload or fueling will be required. This eliminates the need to store or handle the two propellants.

1.5 Basic Mission Description

The objective of the proposed tests is to determine the interception capabilities of air defense missiles and the reliability of tracking instrumentation. Explosive warheads will not be utilized by LANCE as a target missile. The warhead section will carry either ballast or instrumentation. A LANCE (or possibly two LANCEs) will be launched and intercepted by an air defense missile (such as Patriot or the Navy SM-2 missile). An interception will result in the explosion of the missiles. If the interception does not occur, then the missiles will impact in areas determined prior to the test.

Some tests may only involve testing radar and other tracking devices. These types of tests will consist of launching a LANCE, which will travel its ballistic trajectory, and impact monolithically in a predetermined existing impact area or an area surveyed for biological and cultural elements prior to testing (such as northwest of Rowl Site). The radar system or tracking device will be set up in an existing site or area previously evaluated in the testing project's National Environmental Policy Act (NEPA) document from where it will attempt to detect and monitor the flight of LANCE. These tests may be conducted in conjunction with interception tests, as well as independently.

LANCE missiles will arrive at WSMR as wooden rounds, which means they are certified ready to fire. If a missile is not used immediately, then it will be stored at the missile storage facilities at Logistics (DOL-A). Additionally, a limited number of missiles can be stored at the project controlled facilities: Lance Missile Assembly Building (Lance MAB) and the Missile Assembly Building No. 18 (MAB-18).

The following is a description of the preparations required for LANCE immediately prior to firing. Typically, fins are attached, the missile is elevated as required, and LANCE is aimed by conventional artillery sighting equipment. A monitor programmer makes the necessary checks of critical missile guidance components and inputs the flight parameters into the missile. Next, the portable firing device is then unreeled to a safe area (usually behind a earthen berm) approximately 100 meters away and activated on command.

On average eight LANCE firings will occur within a year. A proposed eight and eleven firings have been scheduled for 1995 and 1996, respectively. During a single mission, it is estimated that not more than two LANCEs will be fired. Many of the launch positions contain two launch points; therefore, multiple launches can occur from one site. In the past, there have been simultaneous launches from two different sites, such as LER-4 and LC 39.

Duration of a single test will be dependent on the air defense missile testing program which will utilize LANCE. LANCE was designed to be a system which is easy to set up, fire, and evacuate the area. The greatest amount of instrumentation and support involved with a LANCE is a result of the range support and requirements by the intercepting air defense missile. The estimated time from which the LANCE project occupies the launch site, conducts the mission, and evacuates the site is one week.

Rotary aircraft will be utilized during surveillance and recovery stages of testing. Aircraft will transport Warheads Branch personnel to locate missile debris. Once located recovery and Explosive Ordinance Disposal (EOD) personnel will be transported to conduct the necessary recovery operations. The helicopters will fly in accordance with Army Air regulations.

1.6 Description of Impact Types

There are two types of possible impacts associated with utilizing LANCE as a target. If the test mission is an interception mission, then the impact will consist of pieces scattered over a large area. If the test mission is strictly a tracking mission, then LANCE will impact monolithically at a predetermined impact area.

Monolithic impacts bury into the ground producing a crater typically 3 - 4.5 m wide and 2.2 - 3.6 m deep where the missile enters. A few small pieces of missile debris (less than 15 cm) are found around the crater. The missile usually buries itself upon impact to a depth of 4.5 - 6 m. The fuel tanks typically rupture upon impact burning the residual IRFNA, which is evident by the reddish brown cloud produced at the point of impact. Residual UDMH will leak into the soil system and react with the air.

1.7 Launch and Impact Locations

Launch and impact areas associated with LANCE as a target cannot be determined at this time. The areas for use must meet the intercepting missile or tracking system's project

parameters. Therefore, required areas for launching and impacting could potentially change for every intercepting missile or tracking mission.

The lack of being able to define the exact affected area obligates the intercepting missile project to provide additional environmental documentation to the WSMR Directorate of Environment and Safety Environmental Services Division (DES-E) office prior to the proposed testing if the project plans to utilize areas not specifically discussed in this document. The first step in this process is to provide a "Proposed Action", which will provide details of the proposed activity including the location utilized for launching both LANCE and the intercepting missile, proposed intercept point, and impact areas of LANCE and the intercepting missile if the mission is unsuccessful. If the "Proposed Action" requires development or construction of a site or the use of an area which has not been frequently utilized, then a Record of Environmental Consideration (REC) may be required. The REC will be delivered to the DES-E office at least one month prior to the proposed mission. Included in the REC will be the proposed action, results of both threatened and endangered species and archeological surveys, and mitigation measures. Sufficient time is required to conduct surveys which may take more than a month to complete.

Launch and impact sites which have a high probability of being utilized for the proposed actions are those which were previously used by the Lance project or have developed facilities (Figures 2 a, b, and c). These areas will be considered in this document. Launch areas which will probably be utilized include. Launch Complex (LC) 32, LC 33, LC 39, LC 50, LER - 4, Nancy Site, Chile, Brillo, Shot, Rad, RATSCAT, Tula G, Deer Horn, Spec Site, Fair, and the gravel pit near the mouth of Rhodes Canyon (north of Ram Site). Impact areas which will probably be used include: 9 Lance Marker (LM) sites, all the G sites, all the WITs (excluding Pup) and near Rowl Site. LM sites are only surveyed points used for aiming purposes and not maintained in any manner. The approval of establishing these points was covered in U.S. Army 1989a and 1989b. Several points were determined unsuitable due to environmental impacts and removed from consideration as potential impact areas.

1.8 Safety Concerns

UDMH and IRFNA associated with LANCE result in serious safety concerns. LANCE will arrive at WSMR refurbished and certified ready to fire. Therefore, handling of the missile and its fuels will not be extensive. The greatest safety concern for personnel occurs during the recovery and cleanup operations associated with LANCE.

Health hazards associated with UDMH range from nose, throat and upper respiratory tract irritation to damage to the kidney, blood, and liver which can be fatal. This chemical can enter the body via inhalation, ingestion, and absorption through the skin. The health hazard associated with IRFNA is the potential to burn. The acid gases or the mist can cause severe burns when inhaled or upon contact with the skin. A Standing Operating Procedure (SOP) has been written for the recovery of LANCE (Appendix C). Any personnel involved in these operations will be briefed regarding the hazards and procedures associated with LANCE, in addition to reading the SOP.

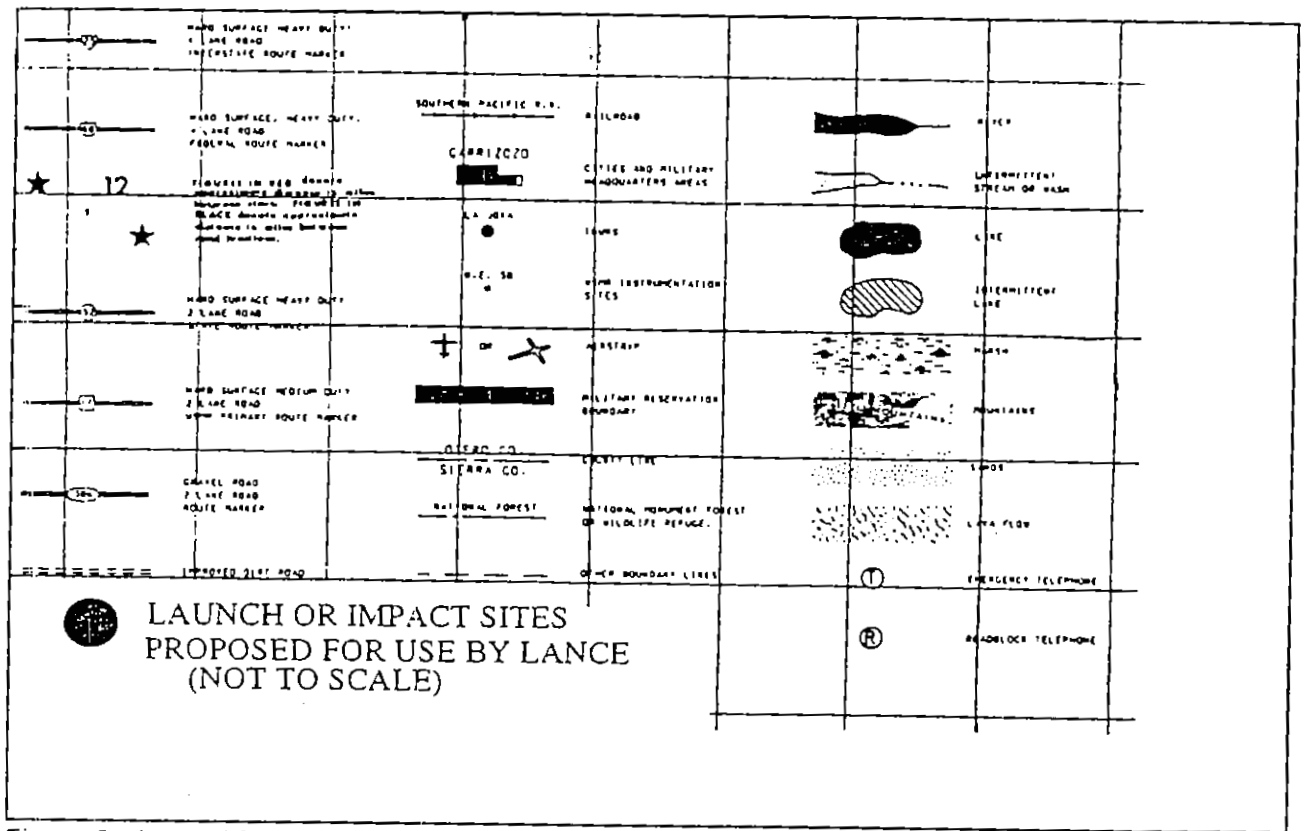

Figure 2. Legend for the following figures.

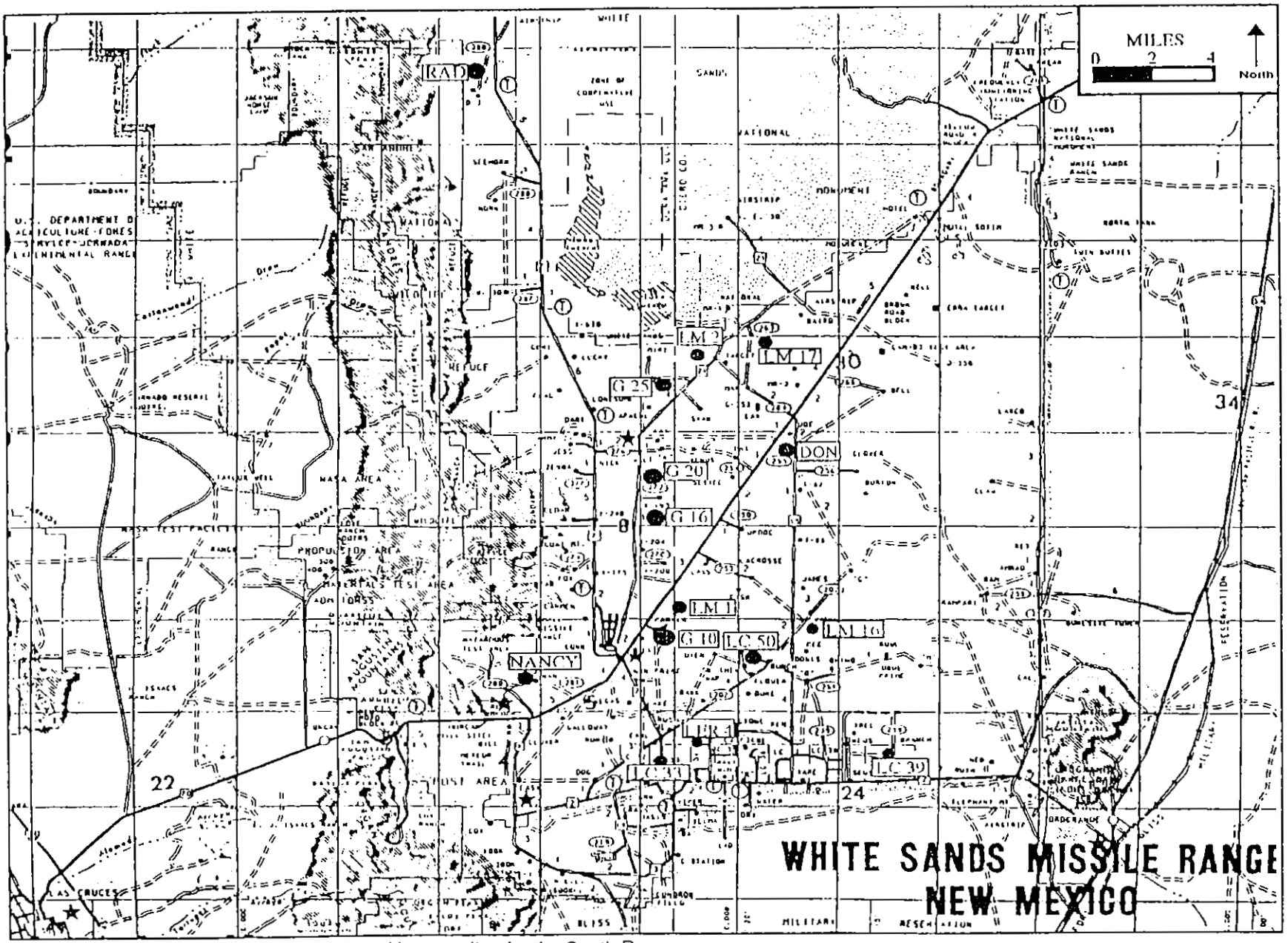

Figure 2a. Location of potential launch and impact sites for the South Range.

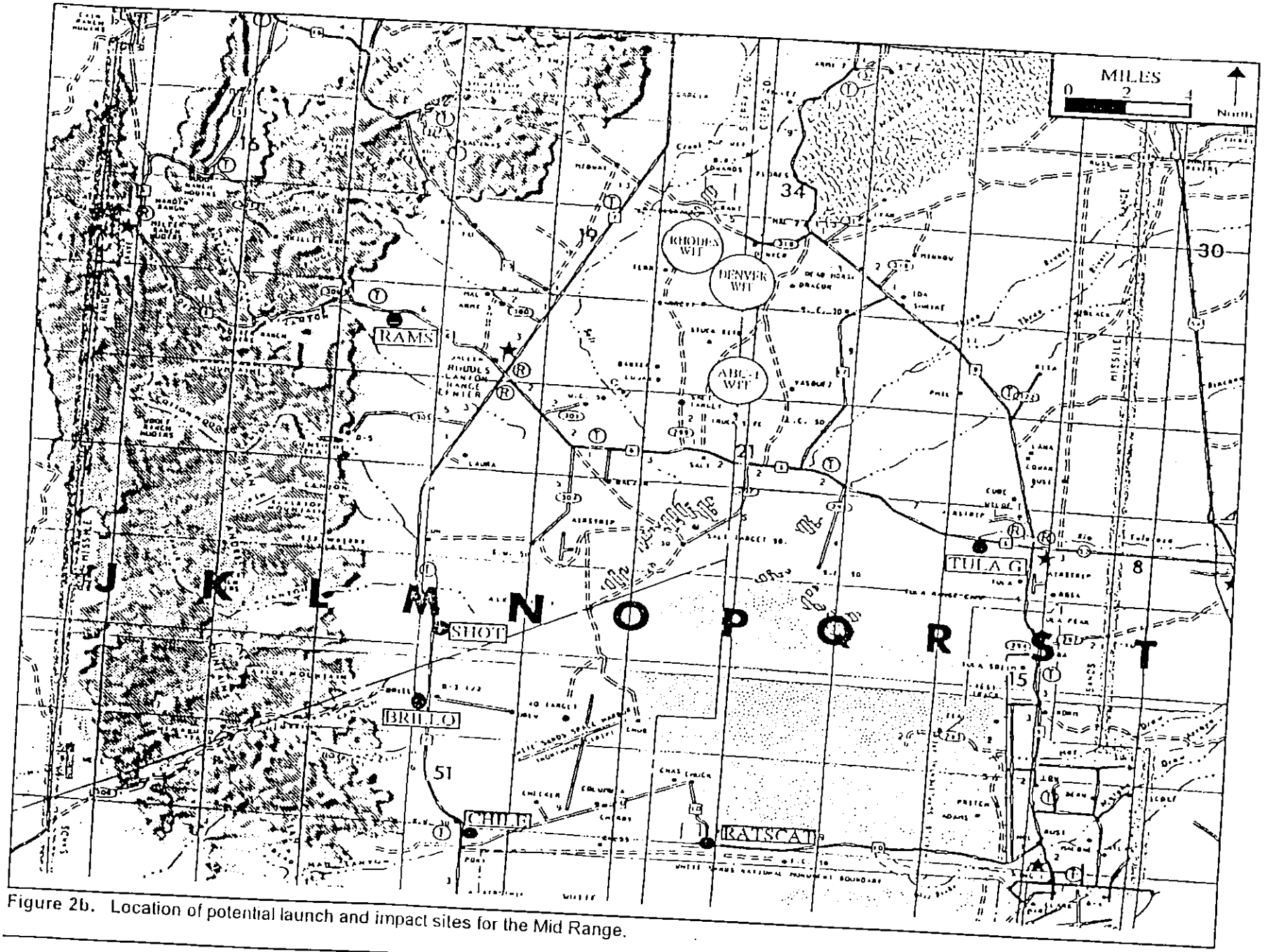

Figure 2b. Location of potential launch and impact sites for the Mid Range.

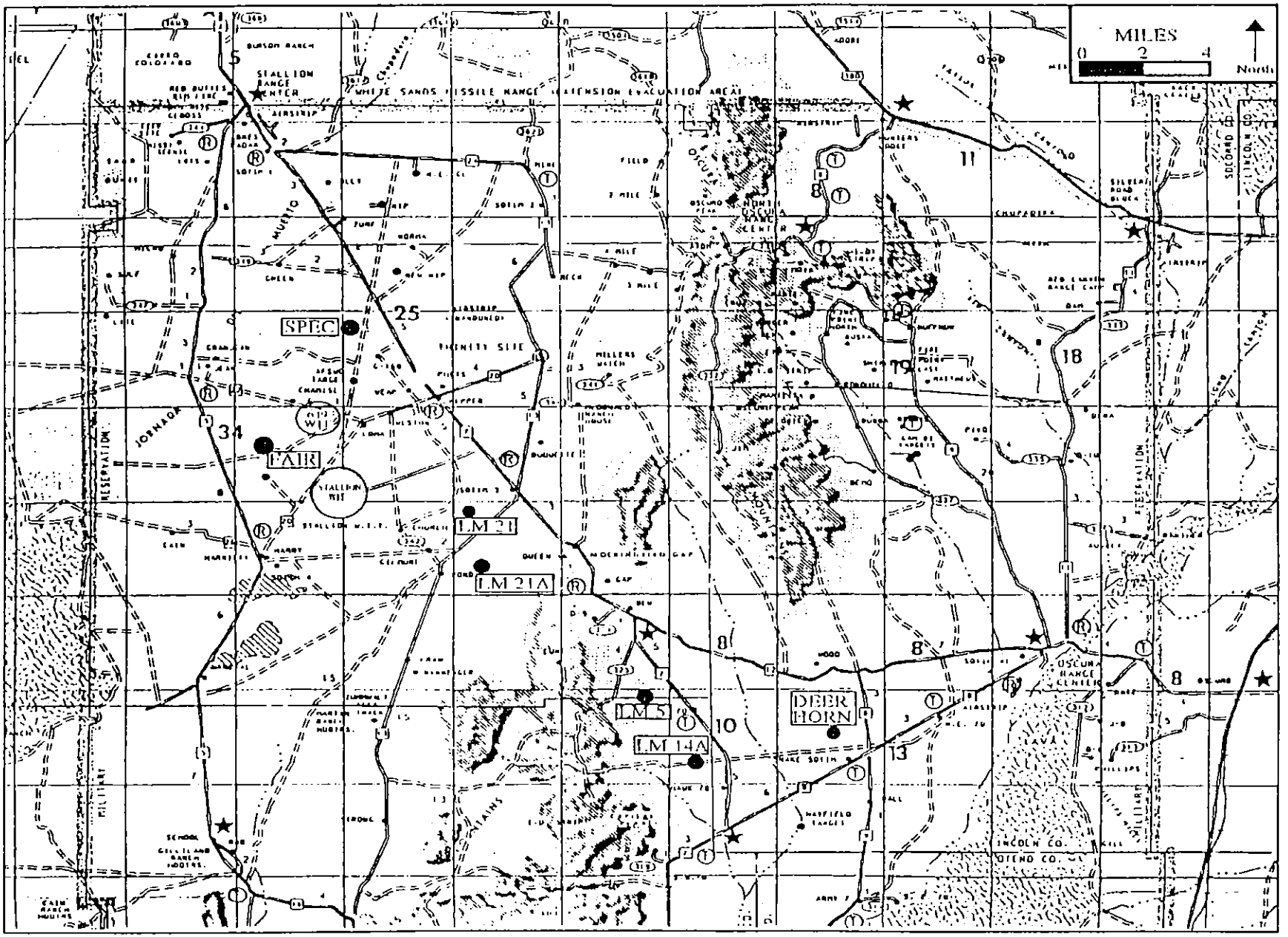

Figure 2c. Location of potential launch and impact sites for the North Range.

Generally, the impact area will not be entered for 24 hours after impact. This allows time for residual fuels to degrade and dissipate. The first personnel to enter the area are the Initial Entry Team (IET). They monitor the UDMH and NO_2 concentrations and determine when it is safe for recovery and cleanup personnel to enter. Additionally, IET dictates required safety apparatus and clothing worn by personnel. The levels of UDMH and NO_2 will be continuously monitored throughout the entire process. Any debris collected will be transported in approved containers to Special Weapons Assembly Building (SWAB) - 5.

1.9 Recovery

Recovery of LANCE will be the responsibility of the Lance project. Similarly, recovery of the intercepting air defense missile will be the responsibility of that project. Two types of impacts may occur depending upon whether LANCE was intercepted. If intercepted, LANCE will explode into many pieces. If there is no interception, then the missile will impact monolithically. The recovery for these two impact types are treated differently. Both recovery methods will use a WSMR Army Air helicopter for locating the site of impact and if necessary transport recovery and EOD personnel to the site. This aircraft will fly in accordance with the Army Air regulations and will be utilized for surveillance immediately before and after a test.

Debris from an intercepted LANCE will be scattered over a large area. The debris is recovered and then given to the Warheads Test Branch of the Materiel Test Directorate (MTD-AW) for analysis. After analysis, MTD-AW makes arrangements for the debris to be disposed of as hazardous material.

The first group of personnel to enter the vicinity of a monolithic impact are IET personnel. IET will set up sensors around the crater to monitor the hazardous material associated with this missile. Once IET decides the area is safe for entry, recovery personnel enter the area and retrieve the data needed.

A monolithic impact will result in the missile burring itself. A crater (typically 3 - 4.5 m wide and 2.2 - 3.6 m deep) is produced with a few small pieces of missile debris (less than 15 cm) found around the crater. The missile itself is not visible within the crater. The debris pieces are collected and placed within the crater. A thin layer of dirt is placed over the pieces to reduce the metallic shine that may affect succeeding test programs. The crater is left open for six months to aid in the dissipation of the propellants and then backfilled. Equipment used to fill the crater is generally a backhoe or armor plated grader. Soil which was forced out of the ground upon impact is used to fill the hole. If additional soil is required it is obtained from mounds located within the WIT.

The air defense system which is utilizing LANCE as a target vehicle will be required to recover their own missile. The procedures for their recovery are presented in the NEPA documentation which corresponds to their activities.

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2.0 AFFECTED ENVIRONMENT

A majority of the potential launch and impact areas for this project are located on the floor of the two basins that comprise a significant portion of White Sands Missile Range; Jornada del Muerto and Tularosa Basins. This section of the EA will discuss features of these basins in order to understand the affected environment.

2.1 General

WSMR lies primarily in the Tularosa Basin of south central New Mexico and extends into the Jornada del Muerto Basin (Figure 3). Mountain ranges comprise approximately 35% of the total land area on WSMR including the San Andres, San Augustine, Organ, and the Oscura mountains. WSMR Main Post lies 72 km north of El Paso, Texas, 72 km southwest of Alamogordo, and 45 km east of Las Cruces, New Mexico. The range occupies more than 8,100 km^2 and is approximately 176 km north to south and 64 km east to west.

The lowest elevation in the Tularosa Basin is approximately 1,185 m and occurs in the west-central part of the basin near Lake Lucero. Elevation in the Jornada del Muerto Basin varies from 1,185 m to 1,383 m. The summit of the San Andres mountains (Salinas Peak) is more than 2500 m in elevation.

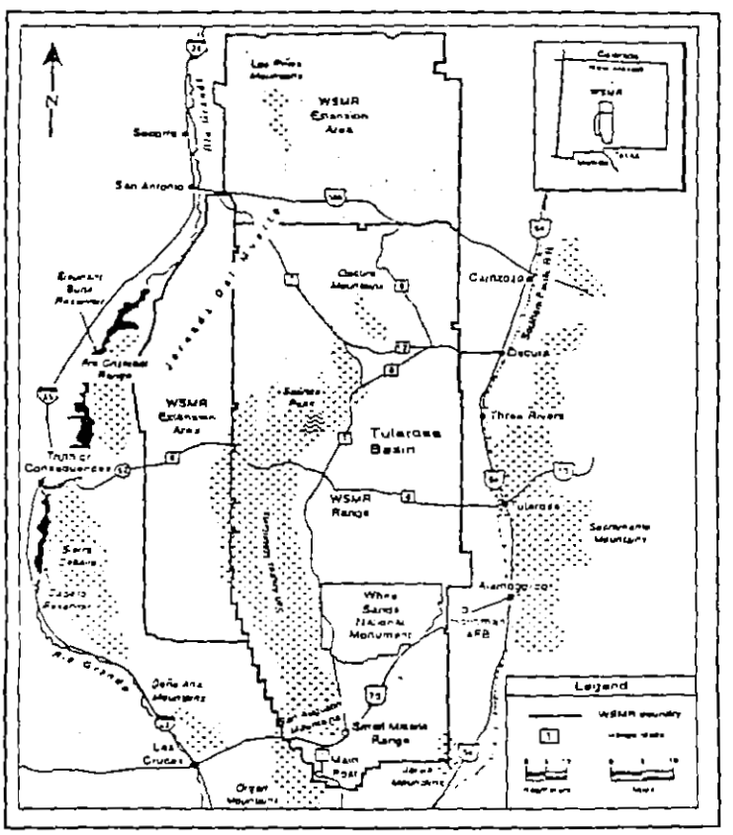

Figure 3. Location of WSMR.

2.1.1 Tularosa Basin

The Tularosa Basin is a structurally continuous depression more than 321 km long and 40 to 97 km wide. This basin is divided into the Tularosa Basin on the north and the Hueco Bolson to the south. The division begins ambiguously on a topographic divide just north of the Texas-New Mexico state line. The relatively flat surface of the divide slopes east to west, ranging in elevation from 1,216 to 1,307 m.

Eolian (wind) deposits on the range are constantly moving due to high surface winds sometimes causing major dust storms. Coppice dunes occur over a wide area of the basin and consist of loamy, fine sands to depths greater than 1.5 m. Between the dunes, fine sandy loams and clay loams occur where the soil has not been blown away. These areas are stabilized to an extent by mesquite (*Prosopis glandulosa*), fourwing saltbush (*Atriplex*

canescens), mesa dropseed (*Sporobolus flexuosus)*, snakeweed (*Gutierrezia sarothrae*), and a variety of annuals. Disturbance to the dune structure accelerates the natural rate of erosion.

2.1.2 Jornada del Muerto Basin

The Jornada del Muerto Basin is a broad valley defined by the Oscura, San Andres, and Organ mountains on the east and the Fra Christobal Range and Sierra Caballo to the west. It is a level or gently undulating basin with no permanent streams or surface drainage outlets, measuring 193 km long and 24 to 48 km in width.

The basin consists of unconsolidated Pleistocene fragmented rocks. This alluvial fill from the nearby mountains reaches depths of 91 m in areas. Coarse sediments are located near the foothills while finer soil particles are located in the lower elevations.

2.2 Present Land Use

WSMR was established in 1945 and is used today for testing and developing missile technology. It is the largest overland testing facility in the continental United States and is administered by the U.S. Army. Resources are available for all branches of the Armed Forces and government agencies. Facilities are also available, on a limited basis, for foreign governments, and private industries, both American and foreign (U.S. Army 1993a).

Encompassed within the WSMR boundaries are White Sands National Monument, San Andres National Wildlife Refuge, and two National Historical Landmarks; Trinity Site and LC 33 (Figure 4). Portions of Holloman Air Force Base, Jornada Experimental Range, and National Aeronautical Space Administration (NASA) are located in co-use areas with WSMR. These areas operate under agreements and are the only areas of WSMR that the U.S. Army does not have unlimited use of restricted airspace. Agencies and organizations use the shared land for a variety of uses including conservation, recreation, research, and livestock production.

White Sands National Monument is primarily used by the public as a recreational area. Airspace above a portion of the monument is designated as cooperative use area which aircraft and missiles are permitted to travel through.

The primary mission of the San Andres National Wildlife Refuge is to protect habitat for desert bighorn sheep (*Ovis canadensis mexicana)*, a state endangered species. This area is restricted to public use, but permits some scientific research to be conducted within its boundaries.

The public is permitted access to the two National Historical Landmarks on special occasions, such as benchmark anniversaries of the sites or WSMR. These events are organized and scheduled through the Public Affairs Office, which will also provide an escort to and from the sites.

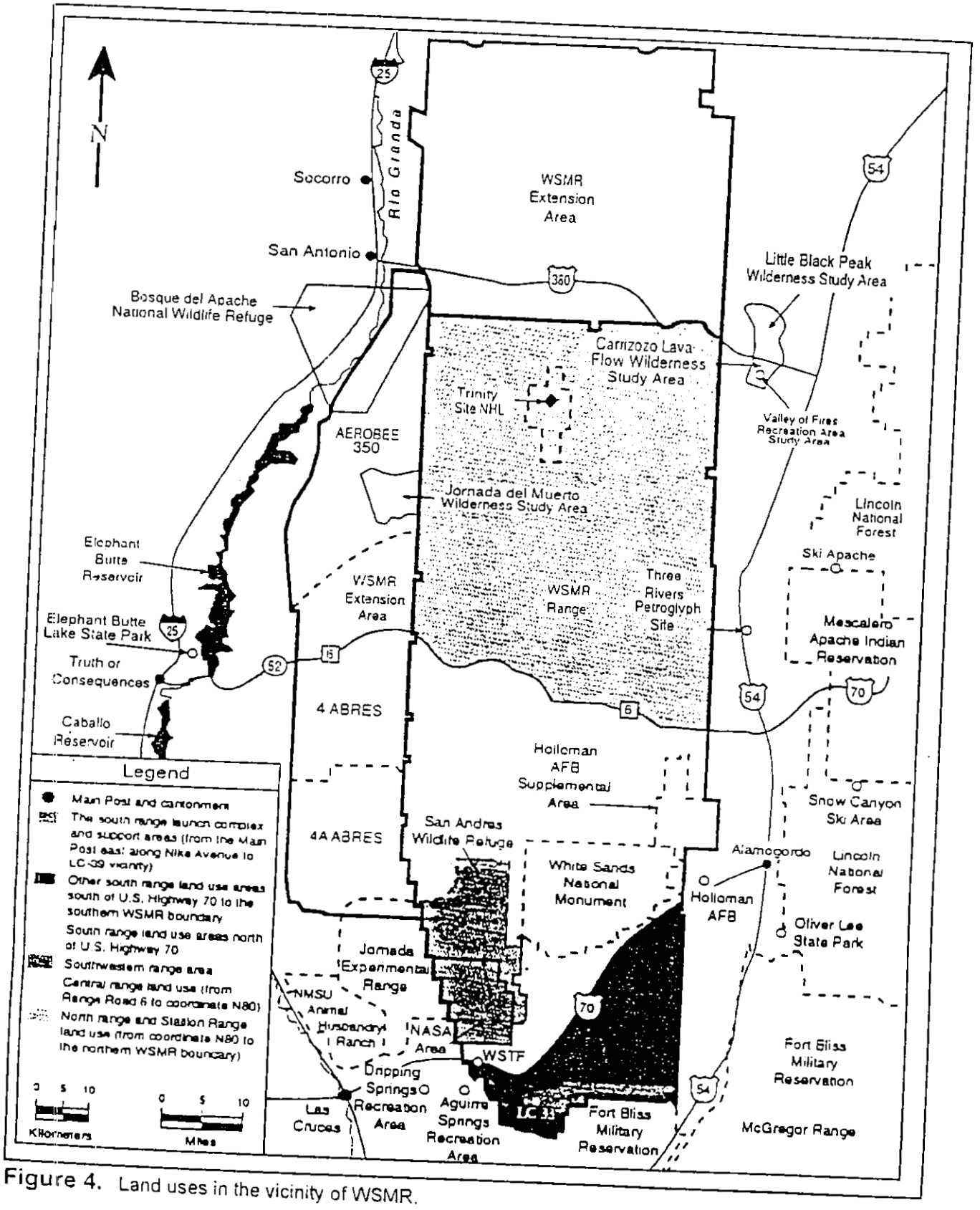

Figure 4. Land uses in the vicinity of WSMR.

Other activities permitted within the boundaries of WSMR, include a number of special hunts during the year (i.e , oryx, pronghorn, and deer), general hunting/trapping, scheduled tours through the public affairs office, biological research (i.e., mountain lion, oryx, springs, etc.), and non-military testing (i.e., vehicle airbags, laser, EMR exposure, etc.). Approvals of these activities are done in accordance with the mission statement of WSMR.

2.3 Geology and Soils

2.3.1 Tularosa Basin

The Tularosa Basin was essentially a stable, relatively shallow marine shelf from the late Cambrian through the early Pennsylvanian period. The marine sedimentation buildup was interrupted only briefly by periods of non deposition and minor erosion.

In the late Tertiary period, tectonic disturbances altered the regional landscape, causing great uplifts and tilted fault blocks, which are presently recognized as the Sacramento, Organ, San Andres, Hueco, and Franklin mountains (Figure 5). At the same time, the Tularosa Basin and Hueco Bolson were formed as a complex graben between the fault blocks.

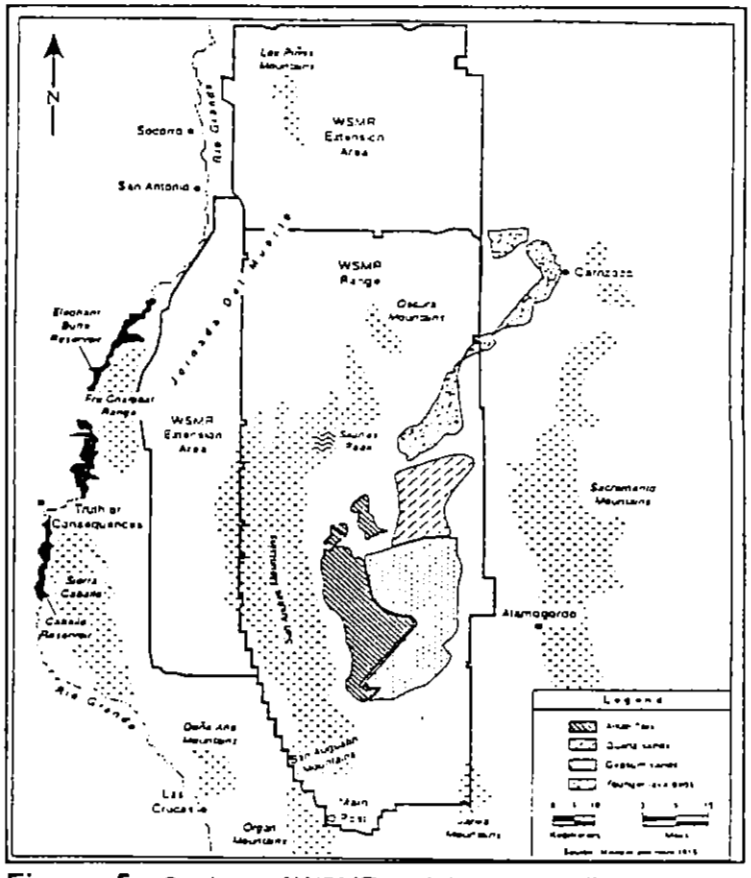

Figure 5. Geology of WSMR and the surrounding area.

Alluvial fans slope outward from the base of the mountains, coalescing to form broad aprons that merge into flatter alluvial plains. Extensive playa deposits and Pleistocene lake deposits occur in the west-central portion of the Tularosa Basin around Lake Lucero. In addition, large portions of the basin are covered by sand dunes. Cemented caliche layers have formed near the surface throughout much of the Tularosa Basin.

Major drainages, stream channels, and associated flood plain deposits associated with them originate in the higher mountainous regions, extend down through the alluvial-fan deposits and across the alluvial plains, terminating in playa lakes. Sediments derived from erosional processes in the mountainous areas are transported downstream during high runoff periods, where they form stream and flood plain deposits.

Surface soils on the Tularosa Basin can be placed in the categories of rock outcrops, gravelly and sandy loams, silty and clayey loams, fine sandy loams high in gypsum content, fine sands, and gypsum lands (U.S.D.A. 1976). These soils are the result of weathering of limestone, sandstone, shale bedrock, and the intrusion of eolian (windblown) materials from other areas. Soils are well drained, except impervious caliche layers or bedrock near the surface in some areas.

Gravelly and sandy loams occur in the sediment toes and alluvial fans beside the San Andres mountains. These soils are known to erode rapidly if disturbed. The silty and clayey loams occur on the nearby level terminal flats of the alluvial fans, eastward of the gypsum land, and along the southwesterly directed intermittent streams into the White Sands National Monument area. Sandy loams with a high content of gypsum occur generally in the area east of the gypsum lands.

2.3.2 Jornada del Muerto Basin

The San Andres mountains are formed from a west-dipping fault block, having moderate to steep slopes on the west, and precipitous slopes to the east. Rocks in the mountains are derived from marine sediments deposited in the Paleozoic era. The Jornada del Muerto Basin is predominantly covered with Tertiary to Quaternary alluvium derived from erosion of the San Andres mountains and the Organ mountain formations in addition to materials carried in by the ancestral Rio Grande.

The Jornada del Muerto Basin is considered closed, with no external drainage, but water occasionally collects in the scattered low spots or playas. Sediments found near the foothills are coarse while fine soil particles are found in the lower areas. Both water and wind erosion processes are present and micro relief changes are continuous.

Twenty-two soil types have been described on the Jornada del Muerto Basin (U.S.D.A. 1976). They have almost no humus or organic matter, and have little change in texture between surface soil and subsoils. Lime content in these soil types is high. Through time, lime from the soil and calcareous dust has been leached downward and deposited at the depth to which rainfall normally penetrates, from a few inches to several feet. This zone of lime accumulation, or caliche layers, is often so thick and dense that neither water nor roots can penetrate it.

2.4 Ground and Surface Water

2.4.1 Tularosa Basin

Ground water associated with the Bolson-fill aquifer in the Tularosa Basin supplies WSMR with its primary water needs (98%). This aquifer is confined by the San Andres, San Augustine, and Organ mountains to the west and saline groundwater to the east. The movement of the groundwater from this aquifer runs west to east and southeast. The aquifer is recharged by ephemeral arroyos, large storms, and treated water from the waste water treatment plant at WSMR (Risser 1988).

Quality of the ground water has been described as having three zones (Risser 1988). The calcium bicarbonate water zone is found in the area where most recharging probably occurs resulting in only a small concentration of dissolved solids present. The shape of the zone is related to the presence of arroyos on the land surface. East of the calcium bicarbonate zone lays calcium bicarbonate sulfate water. Sodium chloride sulfate brine water is the third zone and is found in the eastern portion of this aquifer. This water type is characteristic of most of the groundwater in the Tularosa Basin (Risser 1988). Fresh water is found in alluvial fan deposits along the east and west sides of the Tularosa Basin.

Water for drinking and domestic purposes is supplied by eleven gravel packed wells. These wells have a depth of approximately 243 m and are found on the alluvial fans near the Organ mountains. A pipeline extends eastward to Orogrande Range Camp providing water to the south launch complex. Remote sites require water to be transported by water containers or water tanks to the site for personnel. The Main Post of WSMR is the primary user of water, averaging more than 93 percent during 1983 - 1986.

Surface water at WSMR is found mainly in the Tularosa Basin and is normally low quality (highly saline and nonpotable). Combination of intermittent and permanent sources are present. Intermittent streams, lakes, and potholes fill with water after heavy rains. Lake Lucero and Big Salt Lake nearly always have standing water in them. One perennial stream, Salt Creek, runs through the northern portion of the Tularosa Basin and empties into Big Salt Lake. Salt Creek is sustained during dry periods by base flow north of Range Road 6. Two major springs, Malpais and Mound Springs, provide year round water sources. These springs provide man made ditches and water holes with water.

2.4.2 Jornada del Muerto Basin

Jornada del Muerto Basin has its primary aquifer in the Quaternary alluvium. Most of the water is found in the interstices of unconsolidated alluvium material. The chemical quality of the water is unusable for most purposes, domestic and drinking included. The major contaminant is a high sulfate concentration (274-3,160 mg/L). The secondary aquifer is found in the rocks of the Permian Period and is also of poor quality. Movement of water in the aquifer is predominantly westward. Depth to the aquifer ranges from 5.4-104 m below the land surface.

The recharge to the aquifer of the Jornada del Muerto Basin is mainly from the adjacent mountain masses, generally from the east. The recharge of this aquifer is slow because the amount of percolation and runoff from the mountains is not great.

2.5 Climate

South central New Mexico is in the northern portion of the Chihuahuan Desert, which is classified as a hot desert. Annual precipitation peaks during July, August, and September, while spring and fall droughts are regular occurrences. Typically, summer precipitation is generated from the Gulf of Mexico and occurs as convectional storms due to solar heating.

These storms have a short duration and high intensity and are not always effective for plant growth, due to the high summer temperatures (high temperatures result in a greater loss of water by means of evaporation). Winter precipitation is a result of frontal movements from the Pacific Ocean. These storms are less intense and generally longer in duration than those during the summer (Holechek et al. 1989).

Mean annual precipitation in the Tularosa Basin is less than 229 mm with summer precipitation contributing more than 50%. Annual precipitation in the Jornada del Muerto Basin is less than 279 mm.

Temperatures in south-central New Mexico are generally warm, with long periods during the summer that exceed 38°C (>100°F). The warmest temperatures are reached during the months of June and July with the lowest in December and January. Average maximum winter temperature is around 16°C (>60°F) during the day.

Winds at WSMR are strongest between March and early May (Eschrich 1992). Strong westerly winds prohibit movement of precipitation from the Gulf of Mexico into the area creating dry spring months. Westerly winds during this period occasionally produce severe dust storms due to sparse vegetation and dry, loose soil. Dust storms occur frequently in March and April, but rarely during other months (Eschrich 1992).

2.6 Air Quality

Areas have been delineated by the Environmental Protection Agency (EPA) which are called Air Quality Control Regions (AQCRs). Most of WSMR lies within AQCR 6 of New Mexico. Air quality is generally evaluated by the EPA on six standard criteria; carbon monoxide, ozone, nitrogen dioxide, sulfur oxides, fine respirable particulate matter, and lead. The EPA standards are divided into primary and secondary standards. Primary levels are to protect human health with a margin of safety. Secondary levels are to protect the public welfare from any adverse effects of pollutants. These levels can be found in the Code of Federal Regulations 40 CFR 50. AQCRs are classified as being in attainment if the air quality meets the standards or being in nonattainment if it does not. All of WSMR has met these standards and is considered in "attainment." (Doña Ana county is considered a "marginal nonattainment area" for PM_{10}.)

New Mexico Environment Department (NMED) has set ambient standards for the state of New Mexico through Air Quality Control Regulation 201. Standards set by the state are equally strict, if not more so, than the EPA standards. NMED is concerned about the effects of air quality on humans, animals, vegetation, building and art corrosion, visibility, and the general overall quality of life.

The state of New Mexico has a monitoring network established throughout the state, but monitoring within the vicinity of WSMR is not extensive. Concentrations of carbon monoxide and ozone were monitored in Las Cruces from 1985-1990. During this period,

average concentrations of carbon monoxide and ozone did not exceed the set standards. No monitoring of nitrogen dioxide or sulfur dioxide has been conducted on or near WSMR.

Particulate matter (PM) in the air can cause respiratory irritations. Particulates that are small enough to be inhaled are called PM_{10}. Origins for this particulate range from combustion and industrial processes, mining, dirt roads, and motor vehicles. The average concentration of PM_{10} does not exceed the standards in Las Cruces or Alamogordo. Isolated occurrences of the concentration of the particulate rising above the standard, have been associated with spring dust storms. WSMR Environmental Services Division has conducted a monitoring program for PM_{10} concentrations at C Station. The results of the program have shown that the levels of PM_{10} are below the restricted levels. Additionally, a program sponsored by the WSMR Environmental Services Division was initiated in 1993 to monitor the daily visibility near the main post at WSMR. A camera has been placed on top of 100K and takes daily photographs of the Tularosa Basin. These daily photographs are to document the visibility and to be used as a baseline of information. A previous study during 1951 - 1973 averaged a 71 km visibility range.

2.7 Flora

WSMR is located in the northern portion of the Chihuahuan Desert. Generally, there are two different regions of vegetation types, basin floors and mountain ranges. The basin floors contain Chihuahuan Desert grasslands [black grama (*Bouteloua eriopoda*), tobosa (*Pleuraphis mutica*), scattered yuccas (*Yucca spp.*)], Chihuahuan Desert scrub [creosotebush (*Larrea tridentata*), honey mesquite (*Prosopis gladulosa*), dropseed grasses (*Sporobolus spp.*), tarbush (*Flourensia cernua*)], and closed basin scrub [fourwing saltbush (*Atriplex canescens*), burrograss (*Scleropogon brevifolius*), wolfberry (*Lycium spp.*)]. As the elevation of the mountain ranges increase, precipitation tends to increase and temperature decreases. Therefore, vegetation communities on the mountain ranges are very different from those found on the basin floor. Vegetation types which occur on WSMR with increased elevation include plains-mesa grassland, plains-mesa scrub, mountain scrub, coniferous woodland, and coniferous forests.

Additional factors that determine where vegetation communities exist include slopes, exposure to the sun, and soils. Differences in plant cover are related to the soil texture and structure, which are influenced by moisture-holding capacity, aeration, and plant root development. The size and form of many plants of the same species may be different in areas, due to variations in the texture and structure of the soils.

2.8 Fauna

A high diversity of fauna exists within the boundaries of WSMR. Basically due to four reasons; a variety in elevation and climatic conditions, several different land formations (mountains, arroyos, basin floors, etc.), the large size of WSMR, and diverse vegetation associations. Plant communities at WSMR provide adequate habitats for a variety of game and non-game species. Game species include mule deer (*Odocoileus hemionus*),

pronghorn antelope (*Antilocapra americana*), oryx (*Oryx gazella*), desert cottontail rabbit (*Sylvilagus auduboni*), quail (*Callipepla* spp.), and dove (*Zenaida* spp.). Non-game species that inhabit WSMR include blacktailed jackrabbit (*Lepus californicus*), feral horses (*Equis caballos*), porcupine (*Erethizon dorsatum*), pocket gopher (*Thymomys* spp.), and various rodents, reptiles, and amphibians. Non-game birds found on WSMR include a variety of raptors, scavengers, larks, sparrows, and warblers. Furbearing species found on WSMR include coyote (*Canis latrans*), badger (*Taxidea taxus*), bobcat (*Lynx rufus*), and kit and gray fox (*Vulpes macrotis* and *Urocyon cinereoargenteus*, respectively).

WSMR' s various habitat types are home to an abundance of small rodents. Rodents make up the largest number of animals found on WSMR. Families represented on WSMR include Heteromyidae, Cricetidae, Sciuridae, and Geomyidae.

Bird populations on WSMR are comprised mainly of visiting species with few yearlong residents. Summer visitors are primarily insectivores and winter species are primarily granivores that migrate from short grass prairie regions in the north. Only a few bird species that breed in the Chihuahuan Desert are yearlong residents at WSMR, for example, the loggerhead shrike (*Lanius ludovicianus*) and the cactus wren (*Campylorhynchus brunneicapillus*). Most breeding species occurring on WSMR are summer residents including the northern mockingbird (*Mimus polyglottos*), western kingbird (*Tyrannus verticalis*), and Scott's oriole (*Icterus parisorum*). Quail are yearlong residents, while mourning doves are present throughout the year, their numbers fluctuate with migrations and immigrations. Smaller seedeaters are visitors during non-breeding months (July to mid-May). These include lark buntings (*Calamospiza melanocorys*), brewers sparrows (*Spizella breweri*), sage sparrows (*Amphispiza belli*), white-crowned sparrow (*Zonotrichia leucophrys*), and horned larks (*Eremophila alpestris*). Horned larks are known to occasionally remain through the breeding season in grass dominated areas.

Herptofauna commonly found on WSMR include coachwhip snake (*Masticophis flagellum*), long-nosed snake (*Rhinocheilus lecontei*), checkered whiptail (*Cnemidophorus grahamii*), side-blotch lizard (*Uta stansburiana*), and western green toad (*Bufo debilis*). Other characteristic herptofauna are the Texas horned lizard (*Phrynosoma cornutum*) and various rattlesnakes (*Crotalus spp.*).

2.9 Threatened, Endangered, and Sensitive Species

WSMR Environmental Service Division has compiled a list (Appendix D) of potentially occurring plant and animal species on WSMR categorized as threatened, endangered or candidates for listing. This list is derived from lists created by U. S. Fish and Wildlife Service, New Mexico Department of Game and Fish, and New Mexico Forestry and Resources Conservation Division, Energy, Minerals and Natural Resources Department.

Lance activities will occur on the floor of the two basins, thus limiting the number of threatened and endangered species that could be disturbed within WSMR boundaries.

The potential for any listed plant species to occur on the basin floor is unlikely. The majority of listed plant species occur in canyons or remote areas which the project will not be utilizing.

Listed bird species that have been documented on WSMR and are found on the basin floors include the western burrowing owl (*Speotyto cunicularia hypugea*), northern aplomado falcon (*Falco femoralis septentrionalis*), American peregrine falcon (*Falco peregrinus anatum*), ferruginous hawk (*Buteo regalis*), white-faced ibis (*Plegadis chihi*), and loggerhead shrike (*Lanis ludovicianus*).

Burrowing owls have recently been listed as a species of concern. The U. S. Fish and Wildlife Service has information showing that proposing to list this owl may be appropriate. Substantial data on biological vulnerability and threats are not currently available to support the immediate preparation for this action. Burrowing owls have been a common sight throughout WSMR during surveys and are associated with disturbed areas and those areas with moderate continual human disturbance. This species, a year-round resident of southern New Mexico, appears to be stable at WSMR.

Currently, aplomado falcons are not considered residents of WSMR, however, two unconfirmed sightings occurred in 1994 during aplomado falcon presence/absence surveys. Three confirmed sightings were recorded during the spring and summer of 1991 and 1992. Aplomado falcon presence/absence surveys are routinely conducted from February through August by Cortez III Service Corporation in portions of the Tularosa and Jornada del Muerto basins. All bird species observed during these surveys are recorded. Although the survey routes are chosen based upon aplomado falcon habitat requirements, they are representative of the grasslands on the basin floors. Final reports include maps of the survey routes, lists of bird species observed, methodology, and dates conducted.

The American peregrine falcon is rare in south-central New Mexico but has been sighted within the boundaries of WSMR in recent years. Nesting records do not exist for the peregrine falcon on WSMR. Peregrine falcons usually nest on tall inaccessible cliffs and hunt near water for medium sized birds and waterfowl. Activities associated with WSMR may inhibit this bird's occurrence. Those individuals sighted may have been transients. A peregrine falcon was photographed in the Organ Mountains in 1995.

Ferruginous hawks are winter residents of south-central New Mexico and are found on WSMR from November to February. Currently listed as a species of concern, ferruginous hawks inhabit dry, open areas where they can be spotted perched on utility poles or fence posts as they hunt for medium sized mammals.

White-faced ibis are wading birds which feed on invertebrates. Currently listed as a species of concern, white-faced ibis' have been sighted at Brazel Lake and Malpais Springs on WSMR on an irregular basis. In New Mexico the white-faced ibis is an uncommon (locally common) breeding species.

A common resident of WSMR, the loggerhead shrike is currently listed as a species of concern. Loggerhead shrikes frequent semi-open country, with lookout posts, trees, and shrubs. During 1995 aplomado falcon presence/absence surveys loggerhead shrikes were encountered on nearly every survey. This species is easily identified by its distinct black, white, and gray markings and its habit of perching on poles, yucca stalks, and utility wires while searching for prey.

Two additional listed faunal species include the Texas horned lizard (*Phrynosoma cornutum*) and the White Sands pupfish (*Cyprinodon tularosa*).

The Texas horned lizard is WSMR's only reptile species listed as a candidate for Federal listing. It is common throughout WSMR in a variety of habitats consisting of open areas up to 1,829 m with sparse plant growth including bunch grass, cactus, juniper, and mesquite.

White Sands pupfish are restricted to saline waters in the Tularosa Basin, such as Mound Springs, Malpais Springs, and Salt Creek. Populations within these areas appear stable at this time. Habitat degradation by feral horses (*Equis caballos*) is the largest threat to the pupfish. The feral horse population on WSMR has been reduced by approximately 80% during removal operations in 1995 (P. Morrow, WSMR-DES, pers. commun.). An additional threat to the population includes disease, which recently has caused dramatic reductions in their numbers in the Mound Springs population.

2.10 Cultural Resources

Large portions of the Tularosa and Jornada del Muerto Basins have been occupied by the United States Armed Forces since the early 1940's. The study of these areas has intensified over the years and has resulted in the discovery of many cultural sites within the boundaries of WSMR. These cultural sites have been found by investigation due to both military actions and academic research.

Six cultural-temporal categories are applicable to the Tularosa and Jornada del Muerto Basins. These categories are presented in Table 5.

Table 5. Cultural-Temporal sequences applicable to Tularosa and Jornada del Muerto Basins.	
PERIOD	DATE
Paleoindian	900 B.C. - 6000 B.C.
Archaic	6000 B.C. - A.D. 400?
Formative-Jornada Mogollon Mesilla Phase Dona Ana Phase El Paso Phase	 A.D. 400 - A.D. 1000 A.D. 1100 - A.D. 1200 A.D. 1200 - A.D. 1400+
Formative - Rio Abajo Tajo Phase Early Elmendorf Phase Late Elmendorf Phase Ancestral Piro	 A.D. 700 - A.D. 1000 A.D. 1000 - A.D. 1100 A.D. 1100 - A.D. 1300 A.D. 1300 - A.D. 1546
Protohistoric Colonial Piro Manso	 A.D. 1540 - A.D. 1680 A.D. 1540 - A.D. 1870
Historic Apache Spanish/Mexican Euroamerican	 A.D. 1540 - A.D. 1880 A.D. 1598 - A.D. 1860 A.D. 1860 - A.D. 1942
U.S. Military	A.D. 1942 - Present

2.11 Socioeconomic Resources and Infrastructure

2.11.1 Economics

Personnel that support LANCE operations are locally employed (government/contractor). These personnel reside in the local area and provide their own meals and housing. During operations at remote sites restrooms and potable water will be supplied. Electrical power is supplied by local electrical service providers to facilities which have firm power sources. Portable generators will be used at sites without firm power sources.

2.11.2 Transportation

An extensive network of roads provides access to most of WSMR. There are three classifications of the road types on WSMR; major roads, secondary roads, and trails. The major roads are paved two lane roads that can support 1,200 cars per hour. There are four major roads that serve WSMR; Range Roads 1, 2, 6, and 7. Range Roads 1 and 2 are access routes to the Main Post. Range Road 6 extends east to west across the

middle portion of the range and supports an average of 200 vehicles a day. The main route for traveling north and south within WSMR is Range Road 7. Secondary roads consist mostly of unpaved roads. The maintenance of the secondary roads and trails is dependent on project needs and available funding and is therefore infrequent.

2.11.3 Utilities

WSMR owns and operates its own water supply facilities, sewage treatment plant, telephone center, heating and cooling systems.

The Main Post is supplied with water from eleven gravel-packed wells. The well water is pumped, collected in a common collection area, treated, and then distributed. The treatment consists of sedimentation, chlorinization, and fluoridation. The distribution system is based on gravity flow. A pipeline extends from the Central Booster Station to a storage tank at Launch Complex 34.

El Paso Electric Company provides WSMR with most of its electrical needs. Three electric cooperatives (Sierra Electric Cooperative, Socorro Electric Cooperative, and Otero County Electric Cooperative)service limited regions of WSMR. Overhead and underground transmission lines are present on WSMR. Some remote sites operate with portable diesel generators.

Natural gas has been supplied to WSMR by the El Paso Natural Gas Company since 1949. Fuel oil and propane are used to heat those buildings isolated on the range. Storage tanks are provided at these more remote buildings.

The Central Telephone Center on WSMR is owned and operated by the U.S. Government. The U.S. Army Information Systems Command provides the center with all engineering work. A digital switching system was installed before FY1988 and provides capability for 10,500 lines with 1,023 trunks. The interface between the new switches and the gateway to national communications is being upgraded to a T-1 digital system. Fiber optic cable is being put into place (290 km) to augment the microwave system. National communication is provided through the Mountain Bell Las Cruces facility.

Solid waste from the Main Post and surrounding range areas is deposited into a landfill. The landfill is found 4 km east of the Main Post on Watertown Avenue. Collection of waste is done with standard equipment. Approximately 382 m^3 of waste is disposed of daily.

The location and amount of toxic and hazardous waste generated at WSMR are tracked on a computerized system. The waste is disposed of according to WSMR Reg. 200-1. Waste is categorized and stored in the appropriate storage facility on WSMR that includes: HAZMART, Hazardous Waste Management Facility (HWMF), petroleum, oils and lubricants (POL) storage facility, liquid propellant storage areas, pesticide storage area, and Cortez III 90 day hazardous waste storage facility.

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3.0 ENVIRONMENTAL CONSEQUENCES

Environmental concerns associated with the use of LANCE as targets are dependant upon whether the mission is an interception or tracking mission. Explosives will not be used by LANCE; therefore, the primary safety and environmental hazards associated with the proposed testing are the propellants (IRFNA/UDMH). The Warheads Test Branch of MTD (MTD-AW) has completed a study to determine the length of time, the propellants are present in the soil system (Appendix A).

3.1 Intercept Mission

The primary effect of an intercept mission on the environment would mainly be restricted to air quality. An intercept mission would produce a large explosion in the lower atmosphere with the remaining IRFNA/UDMH being converted to various elements including oxides of nitrogen and carbon monoxide (Refer to Table 4, Project Description). The combustion products generated by LANCE will dissipate quickly based on the relatively small amounts of propellant combustion products, prevailing winds, and rapid decrease in ambient air temperature from ground level to an altitude of 4,572 m.

An interception will result in various sized debris fragments impacting the earth which are retrieved during the recovery phase described in Appendix C. Initially, soil compaction would occur from fallen debris, although natural frost heaves (freezing and thawing causing soil movement) will minimize any damage. Frost heaves have been known to undo greater amounts of compaction which resulted from tanks repeatedly traveling over the same area (Thurow et. al., 1993).

Falling debris from an interception may destroy plants located under the debris. The recovery procedures require pieces to be retrieved which will minimize the potential of killing the vegetation located under the debris, due to sunlight depravation.

There is potential for fires to occur as a result of debris pieces landing while still burning. However, fuel loads capable of carrying a large fire on the Tularosa Basin floor are fairly limited. The area south of Highway 70 is predominately mesquite coppice dunes with little understory to carry a fire. The WSMR fire chief will be notified prior to any testing, in order to have adequate fire support "on call". Any fires ignited by LANCE will be immediately extinguished.

Minimal impacts on wildlife will occur during an intercept mission. A few less mobile individual species may be destroyed from a direct impact. The use of established sites minimizes possible adverse effects on threatened or endangered species (listed species) because established sites have altered the local habitat.

3.2 Tracking Mission

A tracking mission would result in a monolithic impact by LANCE. An impact of this type would create a crater approximately 3 - 4.5 m wide and 2.2 - 3.6 m deep, while the missile

would bury itself up to 4.5 - 6 m below the surface. A majority of the propellants are expended during flight resulting in low residual fuel (Refer to Table 2 and 3).

Residual IRFNA is volatilized as oxides of nitrogen (toxic gas) and nitric acid. Repeatedly, a brown cloud has been observed immediately after a monolithic impact (Wilson 1991). It is expected that the cloud is produced by the IRFNA converting to NOx. Affects of oxides of nitrogen include severe irritation to the eyes, skin, mucous membrane, and suffocation. MTD-AW conducted a study which did not detect any NO_2 at the impact site 30 minutes after impact (Wilson 1991).

UDMH is a known carcinogen and plant growth control agent. Residual surface UDMH reacts with oxygen and releases highly toxic fumes of nitrogen oxides. This generally dissipates within 24 hours and sub-surface UDMH is undetectable after six months (Wilson 1991). Therefore, the Standard Operating Procedures for the recovery of LANCE missiles (U.S. Army 1995) requires that the impact craters remain open for six months to allow the UDMH to easily react and dissipate into the atmosphere.

Areas of special concern due to the hazards associated with the two propellants are discussed below.

3.2.1 Water Quality and Supply

The existing water supply system for WSMR serves a working population of approximately 7500 people. Water to support the LANCE program, for domestic purposes only, would be drawn from the WSMR Main Post water supply. Drinking water is transported in small containers to remote testing locations.

Monolithic impacts in hydrologically sensitive areas could potentially pollute ground water, specifically where the water table is shallow (i.e., Rhodes, Denver, ABC-1, and PUP WITs). This potential may exist either directly by residual liquid propellants being driven into the groundwater, or indirectly, residual propellants migrating down into the groundwater supply (U.S. Army 1989a, U.S. Army 1989b). No monolithic impacts will be allowed in areas where the ground water is less than 30 m below ground surface. These areas can only be utilized if the LANCE missile is modified to either tumble and impact on the surface or explode on impact resulting in residual propellants combusting.

The restrictions placed on monolithic impacts will also reduce the potential for impacting surface waters. Residual fuel which may be present in a missile which was equipped to tumble and impact on the surface will not pose a substantial threat to the environment. The fuel tanks will likely rupture upon impact and the fuels will continue to mix releasing emissions into the atmosphere which will readily dissipate. If propellants are not able to mix, then the UDMH will react with the air producing gases. IRFNA will react with most substances releasing gases and excessive heat. Gases produced by both propellants are nitrous oxides which are toxic in concentration, but will readily dissipate into the atmosphere.

3.2.2 Soils

Soil contamination would occur in the immediate area for a relatively short period of time. The study conducted by MTD-AW (Wilson 1991) indicates that the presence of IRFNA/UDMH is undetectable after a period of 30 minutes to six months, respectively. It is recommended that craters be left open for six months after impact to allow UDMH to dissipate.

3.2.3 Flora

A tracking mission (monolithic impact) would create a crater 3 - 4.5 m wide and 2.2 - 3.6 m deep. Established impact areas are maintained by mowing, halting natural seral development. This is required for data collection and safe recovery operations. Therefore, disturbances to the plant communities within these areas is a fairly common occurrence and will occur regardless to whether LANCE is utilized as a target.

Plants within the immediate area of a monolithic impact would be destroyed by direct impact, residual UDMH (plant growth control agent), and potential fires. If the impact is proposed for an area outside of a maintained impact site, then botanical surveys will be conducted prior to the mission to determine the presence of any listed plant species.

3.2.4 Fauna

UDMH is toxic, therefore, any fauna that comes into contact with the residual UDMH would likely die. Many species avoid using impact areas because of the routine disturbances. Some individuals may be killed due to direct impacts or toxic fumes released within the immediate area. However, the loss of a few individuals would not adversely effect the overall population of any species which typically utilize these impact areas. The use of any area outside of an existing launch or impact site potentially requires additional environmental documentation to be determined by WSMR DES - E, such as a REC which will include a survey for listed wildlife species.

3.2.5 Threatened, Endangered, and Sensitive Species

LANCE will utilize existing launch and impact areas. Launch areas are generally cleared of all vegetation and either covered with a layer of base coarse gravel or are left barren. Impact areas are maintained in nearly bare ground to bare ground conditions for the purpose of data collection and debris recovery. Plant species which occur under these conditions are early seral stage plants. Most listed species are mid to late seral stage plants. Prior to the use of any area outside existing impact areas, a survey will be conducted for listed plant taxa.

Of the 6 wildlife species, only the burrowing owl and loggerhead shrike are year-long residents of WSMR. Based on sightings recorded by Cortez III personnel during aplomado falcon presence/absence surveys, both of these species are common on WSMR with apparently stable populations. Of the remaining 4 species, only the ferruginous hawk

regularly occurs on WSMR as a winter resident. LANCE should have no detrimental impact upon the wintering ecology of the ferruginous hawk. The aplomado falcon, American peregrine falcon, and white-faced ibis rarely occur on WSMR, therefore impacts from LANCE will be negligible.

The possibility of a LANCE intercepting an individual of any of the above species, whether on the ground or in the air, is unlikely. LANCE should have no deleterious effect on any of the above species' overall populations, prey species, or any lasting effect on an individuals behavior. All of these birds are highly mobile and vacate the immediate area if disturbed. The toxic fumes (oxides of nitrogen) which could potentially be released by LANCE during monolithic impacts would only effect these birds if they were in the impact area and did not vacate the vicinity upon the monolithic impact. The chances of this occurring are slight.

LANCE is restricted from utilizing Pup WIT due to the presence of White Sands Pupfish in Salt creek, which dissects Pup WIT. This restriction is placed on the project to ensure protection for the pupfish from any mishaps. Prior to the use of any area in proximity to White Sands pupfish habitat, which is not presently covered by environmental documentation, potential impacts to White Sands pupfish will be evaluated.

Individual losses of Texas horned lizards occur frequently from vehicle traffic. Direct monolithic or debris impacts on individuals is highly unlikely. However, toxic vapors emitted from monolithic impacts could potentially kill Texas horned lizards utilizing these areas. The Texas horned lizard population on WSMR is considered stable at this time and any individual losses from direct impacts will not adversely affect the overall population.

3.3 Missile Flight Effects

3.3.1 Air Quality

Pollutants emitted as a result of the use of LANCE include combustion products from internal combustion engines, airborne soil particles from vehicular traffic, minute amounts of hydrocarbons from fuel tanks, and missile emissions. The maximum total expected emissions from LANCE is presented in Table 6. The amount of emissions produced by WSMR commuters per year is considerably higher (Table 7). This region of New Mexico is predominately in "attainment" indicating that features in the area of WSMR (climate and topography) are favorable for dispersion of potentially hazardous emissions. Therefore, the maximum amount of emissions produced by LANCE will not significantly effect the air quality of the region.

LANCE combustion products in Table 6 were estimated using 100 percent combustion, maximum distance traveled, and the estimated total number of LANCE missiles left. Calculations for estimated emissions of commuters is provided in Appendix E.

Table 6 . Combustion products & amounts per LANCE missile.			
Product	Symbol	Kilograms per Missile	
		UDMH	IRFNA
Water	H_2O	63.36	187.10
Hydrogen	H	.65	1.91
Nitrogen	N	48.69	143.77
Hydrogen Fluoride	HF	.88	2.61
Carbon Dioxide	CO_2	45.93	135.64
Carbon Monoxide	CO	10.37	30.62

Table 7. Estimated emissions produced by the daily commuters to WSMR.				
Time	Estimated Fuel Use	Carbon Monoxide	Hydrocarbon	Nitrous Oxides
1 Year	4,33,040 L	2,987,728 Kg	216,502 Kg	389,704 Kg
5 Years	21,650,200 L	14,938,638 Kg	1,082,510 Kg	1,948,518 Kg

3.3.2 Noise

Noise production associated with LANCE activities include: rotary aircraft used in surveillance and recovery efforts, ground transport vehicles associated with project activities, and the firing of LANCE.

Effects of noise on the natural environment are poorly known. Most research has been limited to its effects on humans or on specific animals. Research has been dominated by work on the effects of sonic booms and to a lesser extent helicopter noise.

Depending upon the species, season, and habitat, noise will effect wildlife differently. Human response also varies from person to person due to individual tolerances to noise. Refer to Table 8 for a summary of sound levels and human responses to them.

Helicopters (rotary winged aircraft) produce one of the most disturbing noises to wildlife. Bleich et al. (1990), found helicopters used to survey desert bighorn sheep (*Ovis canadensis*) in California caused strong reactions among sheep. This resulted in the sheep altering their distribution and movements within the limited range available. Low altitude (45.7m) helicopter flights have also been shown to cause American pronghorn (*Antilocapra americana*) to react by running and raptors (Falconiformes) to panic and exhibit frantic escape behavior (when surprised by the helicopter). Geese (Anatidae) appear to be more disturbed by helicopters than turkey vultures (*Cathartes aura*), pronghorns, coyotes, and raptors (Manci et al. 1988). Rotary aircraft will be used in surveillance and recovery efforts for LANCE to locate impact areas and transport personnel to and from these areas.

Table 8. SOUND LEVELS AND HUMAN RESPONSES

SOUND INTENSITY FACTOR	dBA	SOUND SOURCE	PERCEIVED LOUDNESS	DAMAGE TO HEARING
1,000,000,000,000,000,000	180	• ROCKET ENGINE		
100,000,000,000,000,000	170			
10,000,000,000,000,000	160			TRAUMATIC INJURY
1,000,000,000,000,000	150	• JET PLANE AT TAKEOFF	PAINFUL	
100,000,000,000,000	140			
10,000,000,000,000	130	• MAXIMUM RECORDED ROCK MUSIC		IRREVERSIBLE DAMAGE
1,000,000,000,000	120	• THUNDERCLAP • TEXTILE LOOM • AUTOHORN, 1 METER AWAY		
100,000,000,000	110	• RIVETER • JET FLY-OVER AT 300 METERS	UNCOMFORTABLY LOUD	DANGER ZONE
10,000,000,000	100	• NEWSPAPER PRESS		PROGRESSIVE LOSS OF HEARING
1,000,000,000	90	• MOTORCYCLE, EIGHT METERS AWAY • FOOD BLENDER • DIESEL TRUCK, 60 km/hr 15 m AWAY		
100,000,000	80	• GARBAGE DISPOSAL	VERY LOUD	DAMAGE BEGINS AFTER LONG EXPOSURE
10,000,000	70	• VACUUM CLEANER • ORDINARY CONVERSATION		
1,000,000	60	• AIR CONDITIONING UNIT, 6 m AWAY • LIGHT TRAFFIC NOISE, 30 m AWAY	MODERATELY LOUD	
100,000	50	• AVERAGE LIVING ROOM		
10,000	40	• BEDROOM • LIBRARY	QUIET	NO EFFECT
1,000	30	• SOFT WHISPER		
100	20	• BROADCAST STUDIO	VERY QUIET	
10	10	• RUSTLING NOISE	BARELY AUDIBLE	
1	0	• THRESHOLD OF HEARING		

Other noise disturbances (off-road vehicle noise, sonic booms; artificial amplified noise; fishing fleet noise; and low altitude jets) to wildlife as reported by Manci et al. (1988) include: a temporary acoustical threshold shift in kangaroo rats (*Dipodomys* spp.); avoidance of an area and startled responses by herring (*Clupea harrengus*); reduced growth rate in sheepshead minnows (*Cyprinodon variegatus*) and longnose killifish (*Fundulus similis*) and reduced egg viability in minnows; hearing loss after less than 9 minutes of exposure to 95 dB in the Mojave fringtoed lizard (*Uma scoparia*); and the emergence from burrows of spadefoot toad (Pelobatidae) when exposed to 95 dB of recorded motorcycle sounds. Raptors showed "noticeable alarmed responses" when exposed to sonic booms. Ravens responded to sonic boom with raucous calling, flapping, soaring, and chasing. These responses are temporary and not likely to have deleterious effects on populations of any species. There are some animals that appear to not be bothered by noise at all. American bison (*Bison bison*) were oblivious to 90 dB F-105 overflights; and northern harriers (*Circus cyaneus*) apparently benefited from practice bombing runs by taking advantage of prey flushed out by "bombs" (Manci et al. 1988).

On WSMR, oryx habituate to frequent noise disturbances and human presence. Raptors on WSMR are known to nest in areas which are frequently disturbed by missile range activities (such as near impact areas) and successfully fledged young in 1995 (S. Lerich, pers. observ.).

LANCE launches are quiet relative to other systems, although no dB levels are available at this time. All missile and rocket launches on WSMR are within the Occupational Safety and Health Act (OSHA) standard of 115 dBA within a 15-minute duration. The majority of noise produced by LANCE is confined to the launch site. Appendix F refers to the surface danger zone for LANCE. Areas outside of 500m (area C) are considered safe for unprotected personnel and equipment. It is likely that any wildlife outside of area C will not suffer any lasting effects from LANCE. The activity associated with a launch will result in wildlife vacating the area or taking refuge in a protected site (burrow) where acoustical damage is unlikely.

Noise levels during the flight will dissipate in the atmosphere. The levels that reach the ground should not be great enough to cause damage. Tracking missions result in a monolithic impact which will produce a short duration noise at the impact site. Because of the remote location and prior evacuation of all personnel from the area, these noises should not effect any humans. Any wildlife in the immediate area will experience the noise and most likely react with brief alarm or flight behavior. Impact sites are utilized on a regular basis and any wildlife using these areas are most likely habituated to the frequent disturbances which occur.

The Lance project will initiate an annual survey to identify raptor nests in proposed launch and impact areas. Surveys will consist of inspecting a 1km radius around the center of proposed launch and impact areas during each breeding/nesting season. If an active nest

is detected, DES-E will be consulted immediately. Information collected during these surveys, combined with data collected during previous aplomado falcon surveys, may then be used to developing a database which could aid in identifying low tolerance species and frequently used nesting habitat within WSMR. This, in turn, could minimize future impacts on nesting raptors. Although delaying test activities would be beneficial to nesting individuals, if long term protection is the goal, observations should be made to identify the response of raptors to various acoustical disturbances within the immediate area.

Interception of a LANCE and another missile will occur well above ground level. Noise associated with an intercept will disperse in the atmosphere and not impact upon humans or wildlife. Falling debris, due to an intercept, will produce low frequency, short duration noise at the point of contact with the ground.

Rotary aircraft used for surveillance and recovery stages of testing will fly in accordance with existing Army Air regulations. Helicopters produce noise levels as high as 97.3 dBA while flying and landing. This level of noise is also of short duration and should produce no lasting impact upon human or wildlife auditory systems or their behavior. In areas routinely visited by helicopters wildlife species are likely to be acclimated to the noise or are disturbed very little. Impact areas likely to be visited by helicopters are mainly on the basin floors, therefore no disturbing noise should reach the population of desert bighorn sheep in the San Andres Mountains. Additionally the basin floors are vast open areas which provide adequate room for the dispersal of wildlife within the same habitat type.

Noise levels produced by ground transport vehicles associated with project activities should be well within allowable OSHA limits.

3.4 Other Associated Environmental Effects

3.4.1 Climate

Activities associated with using LANCE as targets will not alter the climate of the area.

3.4.2 Geology and Soils

Proposed activities will not affect the overall geology of WSMR. Impacts from off-road activities and monolithic impacts will have the greatest affect on the soil system. Recovery operations will involve air support and minimal off-road travel when existing roads are not available. Necessary off-road travel will be via direct routes to and from the impact site. Recovery activities are discussed in detail in the SOP provided in Appendix C.

All proposed launch and impact sites for the LANCE project are accessible via paved and/or improved roads. However, recovery activities may require off road travel. This activity will be organized to limit the number of vehicles and the most direct route will be used for all travel to and from the site.

Drip pans are required wherever generators are used to mitigate potential soil contamination.

3.4.3 Cultural Resources

Existing launch and impact areas will be utilized whenever possible. If unestablished areas are required for test activities archeological surveys will be conducted. A report presenting the results will be delivered to DES-E one month prior to use.

3.4.4 Socioeconomic Impacts

No additional personnel are required to support LANCE operations. Personnel that support LANCE operations are locally employed (government/contractor). These personnel reside in the local area and provide their own meals and housing. During operations at remote sites restrooms and potable water will be supplied. Electrical power is supplied by local electrical service providers to facilities which have firm power sources. Portable generators will be used at sites without firm power sources.

3.4.5 Transportation

Increases in traffic on existing roads and highways would be well within the designed carrying capacities. Any disruption due to military convoys or road blocks would not be significant to the WSMR commuting traffic, due to their short duration.

3.5 Cumulative Effects

There are relatively few cumulative effects associated with the use of LANCE as a target. The main activity of this project is basically launching a target vehicle. Therefore the greatest potential impact would occur where the missile impacts. Ground impacts will occur if the mission is a tracking test. The chance of the missiles impacting in the same location is minimal. However, impacting within the same WIT is probable. WITs are designed for target impacts by projects testing on WSMR. These areas would require extensive clean up efforts prior to altering the use of these areas, regardless of whether LANCE missiles are monolithically impacted within the area.

Using LANCE as a target would produce some positive cumulative effects. Primarily, the reduction of hazardous material and the recycling of materials, resources, and capital. Additionally, this would eliminate the need to handle the propellants as hazardous material because they will combust and the missile will be reduced to fragmented pieces. The alternative to this process is to static test the missiles until as much fuel is burned as possible and then handling the remaining fuel and missile structure as hazardous waste. Using LANCE as a target recycles the materials and resources that were previously allocated to the production of LANCE. Thus, additional drones or targets would not be required to be fabricated as LANCE missiles are already in place for utilization as a target.

Additionally, whether or not LANCE is used as a target, the projects proposing to utilize LANCE will be testing with other target vehicles. Therefore, the use of LANCE would not necessarily create increased testing or use of facilities because if LANCE were not available as a target these testing groups would use a more traditional target (such as a drone or another missile).

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4.0 MITIGATION MEASURES

This section of the Environmental Assessment summarizes the necessary measures the proposed project must follow to result in having no significant effect on the environment.

4.1 General

Any significant modifications to the proposed project will require approval from the Environmental Office at WSMR and potentially an amendment to this EA. Additionally, an addendum will be required if the program extends beyond 5 years from the time of approval and/or if actions proposed in the EA cause significantly greater impacts on the environment than the ones expected in the approved environmental document.

Launch and impact areas will be surveyed during the nesting season to identify any active raptor nests within close proximity. If nests are located, then WSMR DES-E will be consulted to determine the appropriate action.

Personnel are instructed not to harass, harm, or collect any flora or fauna. Additionally, all personnel will be instructed not to disturb or collect any artifacts. Any artifacts discovered by project personnel will be reported to the WSMR DES-E archeologist.

Potable water will be trucked to remote sites as needed for adequate water supply for all scheduled activities. All program operational sites will be supplied with one portable toilet for every 20 people at the site. These will be installed, serviced, and replaced as needed.

Drip pans will be installed wherever generators are located to mitigate potential soil contamination.

If repair or construction efforts are necessary at a site, then a document will be prepared which includes a detailed description of the repairs or construction to be performed, why they are needed, who will perform the repairs, what the necessary equipment and materials are, and where the materials will be obtained. This document will be provided to DES-E prior to any action.

4.2 LANCE Recovery

The recovery methodologies for LANCE are presented in the Standing Operating Procedure, which has been provided in Appendix C. Basically, a team of individuals referred to as Initial Entry Team (IET), will enter the area of impact prior to any recovery activities. The IET will set up monitoring devices to determine when levels of IRFNA and UDMH are safe for recovery personnel to enter the area. Monitoring will continue throughout the recovery process. The crater formed by a monolithic impact will remain open for 6 months to allow the UDMH to react and dissipate from the soil system. After 6 months the crater will be backfilled. Equipment used to fill the crater is generally a backhoe or armor plated grader. Soil which was forced out of the ground upon impact is used to fill the hole. If additional soil is required it is obtained from mounds located within the WIT.

The use of rotary winged aircraft for locating the impact and transporting IET and recovery personnel minimizes potential impacts created by off road vehicle use. If vehicles are required during recovery operations, then the vehicle will travel the most direct route to the impact area and return by the same route. Only necessary vehicles will travel to the impact site during recovery.

4.3 Personnel Safety

Surface danger areas have been defined for LANCE launch sites. Diagrams and explanations of the associated hazards of these areas are provided in Appendix F. Personnel will be informed of the restricted areas and will vacate these areas during a launch. The surface danger zones are dependent upon the configuration of the missile. The area in front of the launcher is restricted during launches to ensure that any errant missiles and associated debris will not injure any personnel. The area behind the launcher receives direct heat and missile exhaust along with flying debris, such as rocks, dust, dirt, etc. Additionally, the sound levels behind the missile are considered hazardous to personnel for a radius of 500 m. Personnel involved with launching LANCE will be informed of the surface danger areas and equipped with proper hearing protection.

4.4 Intercepting Missile Obligations

Air defense missile programs, which propose using LANCE as a target, must have a written NEPA document which evaluates the activities of their testing program. If this document does not provide specifics regarding the test scenario utilizing LANCE; such as where the missile and LANCE will be launched from and impact into, then a "Proposed Action" must be presented to the WSMR DES-E.

A "Proposed Action" document will provide the launch location for the testing missile and LANCE, the number of testing missiles and LANCEs involved, the proposed interception point(s), the impact location for each missile for tracking tests, and any reports for surveys which have been conducted in conjunction with this activity. If the areas proposed for use are not existing locations, then a Record of Environmental Consideration (REC) may be required. Archeological and biological surveys may need to be conducted prior to the use of non-established impact areas. The time required for conducting these surveys can be lengthy, therefore a Proposed Action must be presented to the WSMR DES-E office at least one month prior to the proposed action. This should be an adequate amount of time for conducting most surveys.

The testing missile will be required to follow the recovery and any additional mitigation measures presented in their NEPA document.

4.5 Testing Location Restrictions

There are areas which are restricted from monolithically impacting LANCE. These areas include; ABC -1, Rhodes, and Denver WITs, any area where the ground water is at a depth of less than 30 m from the surface, and areas of permanent or intermittent water sources.

These restrictions are based on the potential effects of UDMH and IRFNA on the water sources. Areas where the ground water is within 30 m. of the surface can be utilized as impact locations as long as the LANCE missile is equipped with a mechanism which will cause it to tumble, thus impacting on the surface, or explode on impact resulting in burning all of the propellants.

4.6 Threatened and Endangered Species

LANCE will not use Pup WIT as an impact area to any extent. The hazards associated with the chemicals which fuel LANCE are potentially damaging to the White Sands pupfish or their habitat. Therefore, to prevent a "may affect" situation the area will be avoided.

4.7 Hazardous Waste and Material

Any mishaps, including fires, spills, and missiles impacting outside the approved impact areas will be reported immediately to WSMR DES -E. The Lance project will prepare and submit to the WSMR DES-E an accident report which describes measures taken or proposed to decrease the impacts of the incident, and measures proposed to minimize and/or prevent the incident from recurring.

Removal of solid waste, trash, hardware, debris, etc., associated with LANCE will be the responsibility of the Lance project. Any hazardous waste generated by the project will be recovered and disposed of in accordance with the WSMR Hazardous Waste Management Plan.

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5.0 CONCLUSIONS

The use of LANCE as a target for other air defense missiles is proposed in this document. The associated activities have been evaluated to determine potential impacts and the severity of these impacts. Mitigation measures have been proposed to reduce or eliminate any significant impact associated with the project description. There are no significant impacts that could not be mitigated. As long as the project description or scope of the project does not change from that stated within this document, and the mitigation measures are followed, no significant impact to the environment should result due to these activities.

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Appendix A

LANCE missile system propellant study

LANCE MISSILE SYSTEM

PROPELLANT STUDY

NOVEMBER 1991

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WHITE SANDS MISSILE RANGE

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LANCE PROPELLANT STUDY

1.0 BACKGROUND:

a. The Lance missile, which carries a variety of payloads, was extensively tested at White Sands Missile Range (WSMR) during its development. Flight testing began in 1965. The Lance propulsion system is a prepackaged, bi-propellant liquid fuel rocket system using Unsymmetrical Dimethylhydrazine (UDMH) as fuel and Inhibited Red Fuming Nitric Acid (IRFNA) as oxidizer.

b. The Warheads Test Branch, (TE-AW), was tasked to prepare a site specific environmental assessment for the Lance System in 1989. Environmental concerns about flight testing of the Lance missile at WSMR were identified as those pertaining to air quality, which would be affected by combustion products released into the atmosphere during launch and flight of the missile; soil contamination, which would occur as a result of residual unburned liquid propellant products deposited into the soil; and groundwater quality, which could be affected by residual unburned liquid propellant products deposited into the soil and then migrating to the ground water supply, or by direct penetration of the water table with the missile.

c. TE-AW undertook the task of monitoring ongoing Lance missile flight tests as well as revisiting a number of Lance missile impacts from the past 15 years to study the effects of time and the natural environments on the fate of these propellants. The Chemistry Laboratory (TE-AE) and TE-AW comprised an Impact Entry Team (IET) that monitored the Lance missile impact areas for the presence of UDMH and IRFNA. Air monitoring and soil sampling were performed to determine the presence of any chemical contamination of the impact area after a Lance impact. In addition, soil gas sampling was performed at the center of each impact crater. An analysis for UDMH was also performed on some debris that TE-AW recovered from a previous Lance impact at Ben Site (LM15). TE-AW then cleaned the recovered debris, and parts of the cleaned debris were analyzed for the presence of UDMH. The data for the Ben Site debris is presented in Data [illegible].

2.0 OBJECTIVES.

The objectives of this study were to determine:

a. The persistence of these materials in the soil

b. The concentration of these materials.

3.0 INSTRUMENTATION.

3.1 UDMH Monitoring. UDMH concentrations were determined using a Interscan Monomethylhydrazine (MMH) monitor that had been calibrated to monitor for UDMH. The Interscan sampled the air in the impact area for the presence of UDMH.

3.2 Nitrogen Dioxide Monitoring. IRFNA consists of concentrated nitric acid containing added nitrogen dioxide (NO_2). IRFNA monitored by measuring the concentration of NO_2. NO_2 was measured with a calibrated Interscan NO_2 monitor.

4.0 SAMPLING PROCEDURES.

4.1 Sampling Vials. The soil samples were collected in 40 milliliter pre-cleaned Environmental Protection Agency approved screw cap vials with Teflon/Silicone sealing discs.

4.2 Impact Area Monitoring. After each missile impact, the IET monitored the impact area for the presence of UDMH and NO_2. The Lance missile impacts are listed in Section 6.0 Data.

4.3 Soil Samples. Soil samples were taken from each impact crater to determine if there was any residual UDMH. A surface soil sample was taken from the center of each impact crater. Surface soil samples were also taken at the north, south, east, and west edges of each impact crater. In the Rhodes WIT area, nine background samples were taken prior to the Lance missile firing on 6 May 89. On 7 May 89, four surface soil samples were taken at the north, south, east, and west edges of both of the east and west craters. The wipe samples were collected from specific pieces of debris with mechanic towels. On 13 Jun 90, ten soil samples were taken at one foot intervals from each of the seven missile impact craters in LM21. Soil samples were collected from three additional Lance missile impact sites that were excavated. The three impact areas were LM1, LM8, LM15.

4.4 Soil Gas. Soil gas samples were collected from a pipe driven 5 to 6 feet into the center of each impact crater. Soil gas was evacuated from the ground at a constant flow rate of three liters per minute for 15 minutes. The concentration of UDMH in the soil gas was measured with the Interscan monitor.

5.0 ANALYTICAL PROCEDURE.

The concentration of UDMH in the soil samples and on the wipes were determined by an extraction procedure. A weighed amount of soil was extracted in a known amount of water and the extract was analyzed with the aid of a Hewlett-Packard 5880A Gas Chromatograph

(GC). The wipes were extracted in a known volume of water and the extract was analyzed by the GC. All air sampling data is reported in parts per million, volume/volume (ppm-vol/vol). The detection limit for the air sampling is 0.10 ppm (vol/vol) for UDMH and 0.20 ppm (vol/vol) for NO_2. The soil and wipe data is reported in parts per million, weight/weight (ppm-wt/wt). The detection limit for the soil and wipe samples is 5.0 ppm (wt/wt).

6.0 DATA.

The data collected on each Lance missile impact is contained in the data sheets in the appendix. The table below is a list of each data sheet.

TABLE

DATA SHEETS

Data Sheet	DATE FIRED	TARGET	RANGE	PAYLOAD
1	3 May 89	LM21	129 km	M234
2	3 May 89	LM21	129 km	M234
3	6 May 89	Rhodes WIT	41.4 km	M251
4	19 Sep 89	LM17	19.4 km	M234
5	21 Sep 89	LM21	129 km	M234
6	21 Sep 89	LM21	129 km	M234
7	21 May 90	LM21	129 km	M234
8	21 May 90	LM21	129 km	M234
9	21 May 90	LM21	129 km	M252
10	22 Oct 90	LM21	129 km	M234
11	24 Oct 90	LM21	129 km	M252
12	30 Apr 91	LM15	125 km	M234
13	24 Jul 91	LM21	129 km	M234
14	24 Jul 91	LM21	129 km	M234
15	13 Nov 75	LM1	10 km **	
16	4 Dec 81	LM6	120 km **	
17	16 Feb 87	LM15	125 km **	

* - Old Lance missile impact sites that were revisited.

70 DISCUSSION.

7.1 Monitoring Of Missile Impacts Areas:

7.1.1 On 3 May 89, two missile were fired into LM21. Upon arriving at the impact site, the IET established an initial entry

point 50 feet upwind from the impact crater where no UDMH was detected. The IET, equipped with M-20 breathing apparatus, disposable coveralls and rubber gloves, then proceeded into the area. The IET monitored the impact area by measuring the concentration of UDMH in the air. The data is presented in Data Sheets 1 and 2. The IET determined the impact area UDMH concentration was low enough to use the M-15 filter masks. The IET then put on the M-15 filter masks and continued to monitor for UDMH while the area was cleared of any classified material. UDMH was detected at the crater initially after the missile impacted. The highest UDMH concentration detected was 1.36 ppm. The concentration of UDMH decreased with the passage of time. The concentration of UDMH had decreased to a low but detectable level (0.17 ppm UDMH) approximately 1 1/2 hours after the missiles impacted . No NO_2 was detected during any of the monitoring. The IET returned to the LM21 impact area on 5 May 89 and no UDMH was detected at either crater site.

7.1.2 On 6 May 89, one missile was fired into Rhodes WIT. The IET established an entry point 200 feet upwind from the impact craters where 0.1 ppm of UDMH was detected. The Lance missile created two craters upon impact into the Rhodes WIT. The IET suited up and proceeded to the craters. The initial concentration of UDMH detected at the east crater was 5.45 ppm. A circle with a 50 foot radius was staked off around the craters to mark the area where a breathing apparatus would be necessary if any personnel entered the area. After the two craters were sprayed with water, the concentration of UDMH was still greater than 5 ppm and no additional monitoring was performed on 6 May 89. On 7 May 89, the IET re-entered Rhodes WIT and no UDMH was detected at the two crater impact sites. Soil samples were taken from the two crater impact sites. The data is in Data Sheet 3.

7.1.3 On 19 Sep 89, one missile was fired into the southern part of the range. Upon arriving at the impact site, the IET established an initial entry point in an area upwind from the crater where no UDMH was detected. The IET proceeded to monitor the impact area by measuring the concentration of UDMH in the area. A concentration of 0.5 ppm of UDMH was detected at the east edge of the crater initially after impact. No NO_2 was detected in the impact area. The data is in Data Sheet 4. The IET determined the concentration of UDMH in the impact area was low enough that personnel could work in the area without a breathing apparatus. While classified materiel was cleared from the area, the air was continually monitored for UDMH.

7.1.4 On 21 Sep 89, two missiles were fired into LM21. After the first missile impact, 3.0 ppm of UDMH was detected in the center of the crater. No UDMH was detected around the edge of the

crater. After the second missile impact, no UDMH was detected in or around the crater. No NO_2 was detected in the impact area. The data are presented in Data Sheets 5 and 6.

7.1.5 On 21 May 90, three missiles were fired in LM21. After the first missile impact, 0.3 ppm of UDMH was detected at the northeast edge of the impact crater. No NO_2 was detected in the impact area. After the second missile impact, 0.5 ppm of UDMH was detected at the northeast edge of the impact crater. No NO_2 was detected in the impact area. No IET monitoring was performed after the third missile impact due to a brush fire. The data for all three firings is presented in Data Sheets 7, 8 and 9.

7.1.6 On 22 Oct 90, one missile was fired into LM21. A concentration of 0.5 ppm UDMH was detected while approaching the impact site. In the center of the impact crater 0.5 ppm of UDMH was detected. No UDMH was detected around the edge of the crater. No NO_2 was detected in the impact area. The data is presented in Data Sheet 10.

7.1.7 On 24 Oct 90, one missile was fired into LM21. A concentration of 0.2 ppm UDMH was detected while approaching the crater. The concentration of UDMH in the center of the crater was greater than 5.0 ppm. No NO_2 was detected in the impact area. The data is presented in Data Sheet 11.

7.1.8 On 30 Apr 91, one missile was fired into LM15. No IET monitoring was performed after the missile impact due to a brush fire. The IET returned to the impact area on 1 May 91 and no UDMH or NO_2 was detected in the impact area. The data is presented in Data Sheet 12.

7.1.9 On 24 Jul 91, two missiles were fired into LM21. Each missile created a normal impact crater upon missile impact. Both craters were covered up with dirt. The IET didn't enter the impact area until after the second missile was fired. No UDMH or NO_2 was detected at either impact crater. The data are presented in Data Sheets 13 and 14.

7.2 Soil Gas Monitoring. The soil gas monitoring of the impact craters was performed over a period of time and the data is presented in Data Sheets 1-11 for each of impact craters. The impact craters were covered up on 22 May 90. The pipe was pulled up out of each crater such that the pipe is now approximately four feet below the normal ground surface. Soil gas measurements were also taken at the LM21 after the impact craters had been covered up. The data is presented in the appropriate Data Sheets.

7.3 Impact Crater Excavations:

7.3.1 On 9 Jan 90, the Lance impact crater from the 19 Sep 89 firing was excavated. During the excavation, the crater was monitored for the presence of UDMH. No UDMH was detected at the Normal Crater Depth (NCD), and 3, 4, and 5 feet below the surface of NCD. Normal crater depth is 6 feet below the ground surface. The motor was located 10 feet below the NCD and a concentration of 0.2 ppm UDMH was measured from the air near the motor. Soil samples were taken at the NCD, and 3, 4, 5, and 11 feet below NCD. The impact site from a Lance missile fired on 13 Nov 75 was excavated on 23 Jan 90. No UDMH was detected during the excavation. Soil samples were taken at the surface, 2 feet below the surface, at NCD, and 2, 3, and 4 feet below NCD. The data is presented in Data Sheets 4 and 15.

7.3.2 On 23 May 90, the impact crater from the 4 Dec 81 Lance missile firing was excavated. No UDMH was detected at the NCD, 3, 4, and 5 feet below NCD. Soil samples were taken at the surface, NCD, 3, 4, and 5 feet below NCD. The data is presented in Data Sheet 16.

7.3.3 On 13 Jun 90, seven impact craters in the LM21 area were excavated. No UDMH was detected during the excavations. Soil samples were taken at one foot intervals down to a depth of 10 feet. The data is presented in the appropriate Data Sheets.

8.0 OBSERVATIONS.

8.1 The concentration of residual surface UDMH in the impact area after missile impact decreased as a function of time. No UDMH was detectable after 24 hours.

8.2 The concentration of UDMH in the impact craters centers dissipated over a period of time.

8.3 The concentration of UDMH increased for the second series of soil gas measurements for each impact crater monitored.

8.4 There was no UDMH detected in any of the soil samples from the impact craters excavated that were over six months old.

8.5 The IET observed that residual IRFNA volatilized into the atmosphere after the missile impacted, as noted by the reddish brown clouds of NO_2 immediately after the missile impacted.

9.0 CONCLUSION.

The data in this study reveals the LANCE propellant dissipates from the impact crater.

10.0 RECOMMENDATIONS.

10.1 Impact craters be left open for at least six months after each impact to allow UDMH to dissipate.

10.2 UDMH/IRFNA monitoring be continued during all future Lance operations to ensure the health and safety of personnel working in the area.

11.0 GUIDANCE.

The data presented in this report is for guidance only. Questions related to health and environmental issues should be addressed by personnel in the appropriate field.

APPENDIX A

DATA SHEET 1

LANCE MISSILE FIRING - 1ST IMPACT - 3 MAY 89
LANCE MARKER 21 - 129 KM RANGE

1. Air Sampling After Missile Impacts - 3 May 89
UDMH and NO_2, ppm (vol/vol)

a. UDMH

(1)	Initial entry point	ND
(2)	North edge of impact crater	0.08
(3)	South edge of impact crater	ND
(4)	East edge of impact crater	ND
(5)	West edge of impact crater	0.05
(6)	Center of impact crater	0.07

b. No NO_2 was detected in the impact crater

2. Surface Soil Samples - UDMH, ppm (wt/wt) - 3 May 89

North	3.1
South	2.4
East	ND
West	ND
Center of Crater	ND

3. 15 May 89 - The IET returned to LM21 impact site and no UDMH was detected.

4. Soil Gas Sampling - UDMH, ppm (vol/vol)

Time-minutes	21 Sept 89	22 May 90	13 Jun 90
0.5	0.10	1.0	0.00
1	0.10	1.2	0.00
2	0.10	1.25	0.10
5	0.10	1.25	0.10
10	0.10	1.5	0.10
15	0.10	1.4	0.10

SD = Sampling Date
ND = None Detected

5. LM-21 Missile Impact Crater Dig Reopenings - 13 Jun 90
UDMH, ppm (wt/wt)

Depth (feet)	UDMH
Surface	ND
1	ND
2	ND
3	ND
4	ND
5	ND
6	ND
7	ND
8	ND
9	ND
10	ND

Detection Limit 4.0 ppm

DATA SHEET 2

LANCE MISSILE FIRING - 2ND IMPACT - 3 MAY 89
LANCE MARKER 21 - 129 KM RANGE

1. Air Sampling After Missile impacts - 3 May 89
UDMH and NO_2, ppm (vol/vol)

a. UDMH

(1)	Initial entry point	ND
(2)	North edge of impact crater	1.36
(3)	South edge of impact crater	0.24
(4)	East edge of impact crater	0.34
(5)	West edge of impact crater	0.17
(6)	Center of impact crater	0.34

b. No NO_2 was detected in the impact crater

2. Surface Soil Samples - UDMH, ppm (wt/wt) - 3 May 89

North	ND
South	ND
East	ND
West	15.9
Center of Crater	5.7

3. 5 May 89 - The IET returned to LM21 impact site and no UDMH was detected.

4. Soil Gas Sampling - UDMH, ppm (vol/vol)

Time-minutes	21 Sept 89	22 May 90	13 Jun 90
0.5	0.30	1.0	0.00
1	0.50	1.25	0.10
2	0.50	1.25	0.20
5	0.50	1.25	0.30
10	0.60	1.0	0.25
15	0.60	0.9	0.25

5. LM-21 Missile Impact Crater Dig Reopenings - 13 Jun 90
UDMH, ppm (wt/wt)

Depth (feet)	UDMH
Surface	ND
1	ND
2	ND
3	ND
4	ND
5	ND
6	ND
7	ND
8	ND
9	ND
10	ND

DATA SHEET 3

LANCE MISSILE FIRING - 6 MAY 89
RHODES WIT - 41.4 KM RANGE

1. Air Sampling After Missile Impact - 6 May 89

a. UDMH, ppm (vol/vol)

(1) East missile crater 5.45

(2) After spraying the craters, the UDMH concentration was still greater than 5 ppm.

b. No NO_2 was detected in the impact area.

2. Air Sampling One Day After Missile Impact - 7 May 89

a. No UDMH was detected in the Rhodes WIT impact crater area.

b. The missile debris was collected and removed from Rhodes WIT. The truck bed utilized to remove the debris was monitored and an air sample of 0.24 ppm UDMH reading was observed with the Interscan. The bed was sprayed with water, monitored [illegible] and no UDMH was detected.

3. Surface Soil Samples, ppm (wt/wt)

a. 6 May 89 - Rhodes WIT - Before missile launch

Grid Stake Identification	UDMH
50/50	ND
50/48	ND
52/48	ND
48/48	ND
48/50	ND
52/50	ND
48/52	ND
52/52	ND
50/52	ND

b. 7 May 89 - Rhodes WIT - Day after the missile launch UDMH, ppm (wt/wt)

(1) Soil samples collected from in the grid 51/58.

East crater - North side	4.6
East crater - South side	ND
East crater - East side	ND
East crater - West side	ND
West crater - North side	ND
West crater - South side	ND
West crater - East side	ND
West crater - West side	ND

(2) Wipe Samples of the Lance Missile Debris in Rhodes WIT - 7 May 89.

Motor Wipe	ND
Wiring Harness Wipe	ND
Bulk Head Residue Wipe	ND
Aft of Stem	ND

DATA SHEET 4

LANCE MISSILE FIRING - 19 SEP 89
SHORT FLIGHT

1. Air Sampling After Missile Impact - 19 Sep 89

a. UDMH, ppm (vol/vol)

(1) Initial Entry

(a) East edge of the crater	0.5
(b) While the IET approached the crater	0.1

(2) While cleaning the area

(a) North edge of the crater	0.6
(b) South edge of the crater	0.3
(c) East edge of the crater	0.3
(d) West edge of the crater	0.2

*

b. No NO_2 was detected at the impact site.

2. Surface Soil Samples, UDMH, ppm (wt/wt)

North edge of crater	42.1
South edge of crater	5.6
East edge of crater	22.3
West edge of crater	11.5
Center of crater	13.5

3. Soil Gas Sampling, UDMH, ppm (vol/vol)

Time (minutes)	9 Jun 90
0.5	ND
1	ND
2	ND
5	0.1
10	0.15
15	0.15

4. Soil Samples From Missile Impact Excavations
UDMH, ppm (wt/wt) - Excavated 9 Jan 90

1 Scoop	24.9
3 feet below NCD	43.8
4 feet below NCD	30.7
5 feet below NCD	ND
Motor Recovery (15 ft)	ND

5. Soil Excavation

Depth (feet)	20 Sep 90	2 Aug 90
Surface	ND	ND
1	ND	ND
2	ND	ND
3	ND	ND
4	ND	ND
5	ND	ND
6	ND	ND
7	ND	ND
8	ND	ND
9	ND	ND
10	ND	ND

DATA SHEET 5

LANCE MISSILE FIRING - 21 SEP 89 - LM21 - 1ST IMPACT
LANCE MARKER 21 - 129 KM RANGE

1. Air Sampling After Missile Impact.

   a. UDMH, ppm (vol/vol)

(1)	North edge of crater	ND
(2)	South edge of crater	ND
(3)	East edge of crater	ND
(4)	West edge of crater	ND
(5)	Center of crater	3.0

   b. NO NO_2 was detected.

2. Surface Soil Samples, UDMH, ppm (wt/wt)

North edge of crater	12.6
South edge of crater	12.1
East edge of crater	10.6
West edge of crater	13.2
Center of crater	9.7

3. Soil Gas Sampling

Time (minutes)	28 Sep 89	22 May 90	13 Jun 90
0.5	0.10	0	0.00
1	NT	0.5	0.00
2	0.20	0.75	0.00
5	0.10	1.0	0.00
10	0.10	1.2	0.20
15	0.50	1.2	0.10

4. Missile Impact Excavation Reopenings - 13 Jun 90

Depth (feet)	UDMH
Surface	ND
1	ND
2	ND
3	ND
4	ND
5	ND
6	ND
7	ND
8	ND
9	ND
10	ND

DATA SHEET 6

LANCE MISSILE FIRING - 21 SEP 89 - LM21 - 2ND IMPACT
LANCE MARKER 21 - 129 KM RANGE

1. Air Sampling After Missile Impact - 21 Sep 89

   a. UDMH, ppm (vol/vol)

(1)	North edge of crater	ND
(2)	South edge of crater	ND
(3)	East edge of crater	ND
(4)	West edge of crater	ND
(5)	Center of crater	ND

   b. NO NO_2 was detected.

2. Surface Soil Samples, UDMH, ppm (wt/wt)

North edge of crater	ND
South edge of crater	12.1
East edge of crater	ND
West edge of crater	ND
Center of crater	ND

3. Soil Gas Sampling, UDMH, ppm (vol/vol)

Time (minutes)	28 Sep 89	22 May 90	13 Jun 90
0.5	0.05	0.5	0.00
1	0.40	1.0	0.00
2	0.60	1.8	0.00
5	0.70	2.0	0.10
10	0.70	2.0	0.10
15	0.75	2.1	0.10

4. Missile Impact Excavation Reopenings - 13 Jun 90

Depth (feet)	UDMH, ppm (wt/wt)
Surface	ND
1	ND
2	ND
3	ND
4	ND
5	ND
6	ND
7	ND
8	ND
9	ND
10	ND

DATA SHEET 7

LANCE MISSILE FIRING - 1ST IMPACT - 21 MAY 90
LANCE MARKER 21 - 129 KM RANGE

1. Air Sampling After Missile impacts - 21 May 90
UDMH and NO_2, ppm (vol/vol)

a. UDMH

(1)	North edge of impact crater	ND
(2)	South edge of impact crater	ND
(3)	East edge of impact crater	ND
(4)	West edge of impact crater	ND
(5)	Center of impact crater	ND
(6)	Northeast edge of crater	0.3

b. No NO_2 was detected in the impact crater

2. Surface Soil Samples - UDMH, ppm (wt/wt) - 21 May 90
Collected 22 May 90.

North	ND
South	ND
East	ND
West	ND
Center of Crater	ND

3. 22 May 90 - No UDMH was detected at the impact site.

4. Soil Gas Sampling - UDMH, ppm (vol/vol)

Time-minutes	22 May 90	13 Jun 90	1 Aug 90	18 Sep 90
0.5	0.4	0.00	0.3	0.00
1	1.0	0.00	0.3	0.00
2	1.0	0.00	0.4	0.00
5	1.5	0.10	0.4	0.10
10	2.0	0.20	0.3	0.10
15	2.6	0.20	0.3	0.10

5. LM-21 Missile Impact Crater Dig Reopenings
UDMH, ppm (wt/wt)

Depth (feet)	13 Jun 90	1 Aug 90	18 Sep 90
Surface	ND	ND	ND
1	ND	ND	ND
2	ND	ND	ND
3	ND	ND	ND
4	8.3	ND	ND
5	ND	ND	ND
6	16.9	ND	ND
7	15.1	ND	ND
8	ND	ND	ND
9	4.7	ND	ND
10	ND	ND	ND

DATA SHEET 8

LANCE MISSILE FIRING - 2ND IMPACT - 21 MAY 90
LANCE MARKER 21 - 129 KM RANGE

1. Air Sampling After Missile impacts - 21 May 90
UDMH and NO_2, ppm (vol/vol)

a. UDMH

(1)	North edge of impact crater	ND
(2)	South edge of impact crater	ND
(3)	East edge of impact crater	ND
(4)	West edge of impact crater	ND
(5)	Center of impact crater	ND
(6)	Northeast edge of crater	0.5

b. No NO_2 was detected in the impact crater

2. Surface Soil Samples - UDMH, ppm (wt/wt) - 21 May 90
Collected 22 May 90

North	15.5
South	14.3
East	10.0
West	ND
Center of Crater	16.3

3. 22 May 90 - No UDMH was detected at the impact site.

4. Soil Gas Sampling - UDMH, ppm (vol/vol)

Time-minutes	22 May 90	13 Jun 90	1 Aug 90	18 Sep 90
0.5	2.5	0.00	ND	0.05
1	3.0	0.05	ND	0.05
2	3.1	0.05	ND	0.05
5	3.1	0.10	0.1	0.10
10	3.5	0.30	ND	0.15
15	4.0	0.25	ND	0.20

5. LM-21 Missile Impact Crater Dig Reopenings
UDMH, ppm (wt/wt)

Depth (feet)	13 Jun 90	1 Aug 90	18 Sep 90
Surface	ND	ND	ND
1	ND	ND	ND
2	ND	ND	ND
3	ND	ND	ND
4	ND	ND	ND
5	7.6	ND	ND
6	21.8	ND	ND
7	20.1	ND	ND
8	7.8	ND	ND
9	9.4	ND	ND
10	14.3	ND	ND

DATA SHEET 9

LANCE MISSILE FIRING - 21 MAY 90 - 3RD IMPACT
LANCE MARKER 21 - 129 KM RANGE

1. No monitoring or soil samples were taken on 21 May 90 because a brush fire was started by the missile impact.

2. Surface Soil Samples - collected 22 May 90

North edge of crater	ND
South edge of crater	ND
East edge of crater	ND
West edge of crater	ND
Center of crater	14.5

3. 22 May 90 - No UDMH was detected at the impact site.

4. Soil Gas Sampling - UDMH, ppm (vol/vol)

Time-minutes	22 May 90	13 Jun 90
0.5	0.2	0.00
1	0.3	0.00
2	0.5	0.00
5	0.7	0.00
10	0.8	0.30
15	1.0	0.10

5. LM-21 Missile Impact Crater Dig Reopenings
UDMH, ppm (wt/wt)

Depth (feet)	13 Jun 90
Surface	ND
1	ND
2	ND
3	ND
4	ND
5	ND
6	ND
7	ND
8	ND
9	ND
10	ND

DATA SHEET 10

LANCE MISSILE FIRING - 22 OCT 90
LANCE MARKER 21 - 129 KM RANGE

NOTE: Impact covered the crater.

1. Air monitoring after missile impact (ppm UDMH, vol/vol)

While approaching the crater - north	0.5
North edge of crater	ND
South edge of crater	ND
East edge of crater	ND
West edge of crater	ND
Center of crater	0.5

2. Surface Soil Samples - UDMH, ppm (wt/wt) - 22 Oct 90

North	ND
South	ND
East	ND
West	ND
Center of Crater	9.5

3. Soil Excavation

Depth (feet)	23 Oct 90	6 Mar 91
Surface	11.4	ND
1	63.3	ND
2	74.1	ND
3	ND	ND
4	ND	ND
5	ND	ND
6	ND	ND
7	ND	ND
8	ND	ND
9	10.2	ND
10	13.8	ND

3. Soil Excavation

Depth (feet)	25 Oct 90	6 Mar 91
Surface	ND	ND
1	ND	ND
2	ND	ND
3	ND	ND
4	ND	ND
5	ND	ND
6	ND	ND
7	ND	ND
8	ND	ND
9	ND	ND
10	ND	ND

DATA SHEET 11

LANCE MISSILE FIRING - 24 OCT 90
LANCE MARKER 21 - 129 KM RANGE

1. Air monitoring after missile impact (ppm UDMH, vol/vol)

While approaching the crater - north	0.5
North edge of crater	ND
South edge of crater	ND
East edge of crater	ND
West edge of crater	ND
Center of crater	0.5

2. Surface Soil Samples - UDMH, ppm (wt/wt) - 24 Oct 90

North	9.2
South	ND
East	ND
West	ND
Center of Crater	6.8

3. Soil Excavation

Depth (feet)	25 Oct 90	6 Mar 91
Surface	ND	ND
1	ND	ND
2	ND	ND
3	ND	ND
4	ND	ND
5	ND	ND
6	ND	ND
7	ND	ND
8	ND	ND
9	ND	ND
10	ND	ND

3. Soil Excavation

Depth (feet)	25 Oct 90	6 Mar 91
Surface	ND	ND
1	ND	ND
2	ND	ND
3	ND	ND
4	ND	ND
5	ND	ND
6	ND	ND
7	ND	ND
8	ND	ND
9	ND	ND
10	ND	ND

DATA SHEET 12

LANCE MISSILE FIRING - 30 APR 91
LANCE MARKER 15 - 125 KM RANGE

1. No monitoring or soil samples were taken on 30 Apr 91 because a brush fire was started by the missile impact.

2. Surface Soil Samples - UDMH, ppm (wt/wt) - 1 May 91

North	ND
South	ND
East	ND
West	ND
Center of Crater	ND

DATA SHEET 13

LANCE MISSILE FIRING - 24 JUL 91 - 1ST IMPACT
LANCE MARKER 21 - 129 KM RANGE

1. Air monitoring after missile impact (ppm UDMH, wt/wt)

While approaching the crater - north	ND
North edge of crater	ND
South edge of crater	ND
East edge of crater	ND
West edge of crater	ND
Center of crater	ND

2. Surface Soil Samples - UDMH, ppm (wt/wt) - 30 Apr 91

North	ND
South	ND
East	ND
West	ND
Center of Crater	ND

3. LM-21 Missile Impact Crater Excavation
UDMH, ppm (wt/wt)

Depth (feet)	25 Jul 91
Surface	ND
1	ND
2	ND
3	ND
4	ND
5	ND
6	ND
7	ND
8	ND
9	ND
10	ND

DATA SHEET 14

LANCE MISSILE FIRING - 24 JUL 91 - 2ND IMPACT
LANCE MARKER 21 - 129 KM RANGE

1. Air monitoring after missile impact (ppm UDMH, vol/vol)

While approaching the crater - north	ND
North edge of crater	ND
South edge of crater	ND
East edge of crater	ND
West edge of crater	ND
Center of crater	ND

2. Surface Soil Samples - UDMH, ppm (wt/wt) - 1 May 91

North	ND
South	ND
East	ND
West	ND
Center of Crater	ND

5. LM-21 Missile Impact Crater Excavation
UDMH, ppm (wt/wt)

Depth (feet)	25 Jul 91
Surface	ND
1	ND
2	ND
3	ND
4	ND
5	ND
6	ND
7	ND
8	ND
9	ND
10	ND

DATA SHEET 15

LANCE MISSILE IMPACT - 13 NOV 75
LANCE MARKER 1 - RANGE 10 KM

1. Lance Impact Recovery - Excavated 23 Jan 90

Location	UDMH Concentration parts per million (wt/wt)
2-Surface Soil Samples	ND
2 feet below surface	ND
Normal Crater Depth - 5 feet	ND
2 feet below NCD	ND
3 feet below NCD	ND
4 feet below NCD	ND

2. No soil gas data was collected for this Lance Missile impact.

DATA SHEET 16

LANCE MISSILE IMPACT - 4 DEC 81
LANCE MARKER 6 - RANGE 120 KM

1. Lance Impact Recovery - Excavated 23 May 90

Location	UDMH Concentration parts per million (wt/wt)
Surface Soil Sample	ND
Normal Crater Depth - 5 feet	ND
3 feet below NCD	ND
4 feet below NCD	ND
5 feet below NCD (10 feet)	ND

2. Soil Gas Sampling - UDMH, ppm (vol/vol)

Time-minutes	22 May 90	13 Jun 90
0.5	ND	ND
1	ND	ND
2	ND	ND
5	ND	ND
10	ND	ND
15	ND	ND

DATA SHEET 17

BEN SITE - 16 FEB 87
LANCE MARKER 15 - RANGE 125 KM

Samples from Lance impact at Ben Site and the cleaning process:

a. Ben Site Residue — 45.7 ppm (wt/wt) UDMH
Sampled 2 May 89

b. Metal Debris - Ben Site Residue — No UDMH detected
Sampled 16 May 89

c. Cleaning Water - Ben Site Residue — No UDMH detected
Sampled 16 May 89

d. Remains of the Cleaning debris
Sampled 7 Jun 89

(1) Cleaning Residue Bag #1 — 13.4 ppm (wt/wt) UDMH

(2) Cleaning Residue Bag #2 — 11.1 ppm (wt/wt) UDMH

APPENDIX B

ABBREVIATIONS

NCD	-	normal crater depth
ND	-	none detected
NT	-	no sample taken
ppm	-	parts per million
SD	-	sampling date
vol/vol	-	volume/volume
wt/wt	-	weight/weight

Detection Limits (DL):

Air Monitoring	UDMH	0.10 ppm (vol/vol)
	NO_2	0.20 ppm (vol/vol)
Soil and Wipe Samples	UDMH	5.0 ppm (wt/wt)

Appendix B

Material safety data sheets for UDMH and IRFNA

DOD Hazardous Materials Information System
DoD 6050.5-L
AS OF October 1995

SC: 9135
IIN: 006874293
anufacturer's CAGE: 99530
art No. Indicator: B
art Number/Trade Name: CPE810004 UNSYMMETRICAL DIMETHYLHYDRAZINE

General Information

tem Name:
ompany's Name: OLIN CORP
ompany's Street: 120 LONG RIDGE RD
ompany's P. O. Box: 1355
ompany's City: STAMFORD
ompany's State: CT
ompany's Country: US
ompany's Zip Code: 06904-1355
ompany's Emerg Ph #: 203-356-3449
ompany's Info Ph #: 203-356-3449
istributor/Vendor # 1:
istributor/Vendor # 1 Cage:
istributor/Vendor # 2:
istributor/Vendor # 2 Cage:
istributor/Vendor # 3:
istributor/Vendor # 3 Cage:
istributor/Vendor # 4:
istributor/Vendor # 4 Cage:
afety Data Action Code:
afety Focal Point: F
cord No. For Safety Entry: 002
t Safety Entries This Stk#: 002
atus: PE
te MSDS Prepared: 01JAN95
fety Data Review Date: 24JUL95
pply Item Manager:
DS Preparer's Name:
eparer's Company: OLIN CORP
eparer's St Or P. O. Box: 120 LONG RIDGE RD
eparer's City: STAMFORD
eparer's State: CT
eparer's Zip Code: 06904-1355
her MSDS Number:
DS Serial Number: BXNXN
ecification Number:
ec Type, Grade, Class:
zard Characteristic Code:
it Of Issue:
it Of Issue Container Qty:
pe Of Container:
t Unit Weight:

Report for NIIN: 006874293

NRC/State License Number:
Net Explosive Weight:
Net Propellant Weight-Ammo:
Coast Guard Ammunition Code:

Ingredients/Identity Information

Proprietary: NO
Ingredient: 1,1-DIMETHYLHYDRAZINE, UDMH INTENDED CHANGE (IC)
Ingredient Sequence Number: 01
Percent: 95-99
Ingredient Action Code: A
Ingredient Focal Point: F
NIOSH (RTECS) Number: MV2450000
CAS Number: 57-14-7
OSHA PEL: 0.5 PPM
ACGIH TLV: 0.5 PPM
Other Recommended Limit: 0.5 PPM

Proprietary: NO
Ingredient: DIMETHYLAMINE
Ingredient Sequence Number: 02
Percent: 1-5
Ingredient Action Code: A
Ingredient Focal Point: F
NIOSH (RTECS) Number: IP8750000
CAS Number: 124-40-3
OSHA PEL: 10 PPM
ACGIH TLV: 10 PPM
Other Recommended Limit: 10 PPM

Proprietary: NO
Ingredient: WATER
Ingredient Sequence Number: 03
Percent: 0.1-1
Ingredient Action Code: A
Ingredient Focal Point: F
NIOSH (RTECS) Number: ZC0110000
CAS Number: 7732-18-5
OSHA PEL: N/K
ACGIH TLV: N/K
Other Recommended Limit: N/K

Physical/Chemical Characteristics

Appearance And Odor: CLEAR, COLORLESS LIQUID W/AMMONIA ODOR.
Boiling Point: 146F
Melting Point: -71F
Vapor Pressure (MM Hg/70 F): 157
Vapor Density (Air=1): 2.1
Specific Gravity: 0.78
Decomposition Temperature: 700F
Evaporation Rate And Ref: N/K

port for NIIN: 006874293

olubility In Water: MISCIBLE
rcent Volatiles By Volume: 100
scosity:
: (SUPP)
dioactivity:
rm (Radioactive Matl):
gnetism (Milligauss):
rrosion Rate (IPY): N/K
toignition Temperature:

Fire and Explosion Hazard Data

ash Point: 5F
ash Point Method: COC
wer Explosive Limit: 2
per Explosive Limit: 95
tinguishing Media: CO2, DRY CHEMICAL, WATER SPRAY.
ecial Fire Fighting Proc: USE WATER TO COOL CONTAINERS EXPOSED TO FIRE. AR A POSITIVE PRESSURE SELF CONTAINED BREATHING APPARATUS & FULL OTECTIVE CLOTHING.
sual Fire And Expl Hazrds: AUTO-IGNITION TEMP: 482F. ABSORPTION OF 1,1-ETHYLHYDRAZINE BY RAGS/COTTON WASTE/SAWDUST/SIMILAR ORGANIC MATERIALS LL RESULT IN SPONTANEOUS COMBUSTION.

Reactivity Data

ability: YES
id To Avoid (Stability): TEMPS >124F, DIRECT LIGHT, HEAT, SPARKS, OPEN AME, STATIC DISCHARGE & OTHER IGNITION SOURCES.
terials To Avoid: STRONG OXIDIZERS/HYDROGEN PEROXIDE/NITROGEN TETROXIDE/ ORINE/HALOGEN FLUORIDES/HYPOHALITES/FUMING NITRIC ACID (SUPP)
ardous Decomp Products: CO, NITROGEN OXIDES.
ardous Poly Occur: NO
ditions To Avoid (Poly): N/K

Health Hazard Data

O-LC50 Mixture: ORAL LD50 (RAT): 122 MG/KG
te Of Entry - Inhalation: YES
te Of Entry - Skin: YES
te Of Entry - Ingestion: YES
lth Haz Acute And Chronic: INHALATION: NOSE/THROAT/UPPER RESPIRATORY CT/LUNG IRRITATION, PULMONARY EDEMA, LUNG/LIVER/KIDNEY/BLOOD/CNS DAMAGE, OLYSIS OF BLOOD CELLS. SKIN: SEVERE IRRITATION/BURNS/DERMATITIS. EYES: NS/PERMANENT CORNEAL DAMAGE. INGESTION: GI TRACT IRRITATION/BURNS. 1,1-ETHYLHYDRAZINE IS CONSIDERED MUTAGENIC/SENSITIZER.
cinogenicity - NTP: NO
cinogenicity - IARC: NO
cinogenicity - OSHA: NO
lanation Carcinogenicity: NONE
ns/Symptoms Of Overexp: IRRITATION, INFLAMMATION, BRONCHITIS, VOMITING, RRHEA, NAUSEA, DIZZINESS, CYANOSIS, CONVULSIONS, ALLERGIC REACTION, E, SWELLING, REDNESS, DISCHARGE, TEMPORARY BLINDNESS, ABDOMINAL PAIN,

Report for NIIN: 006874293

BLEEDING, TISSUE ULCERATION.
Med Cond Aggravated By Exp: LIVER/KIDNEY/BLOOD/CARDIOVASCULAR DISEASE & ASTHMA.
Emergency/First Aid Proc: EYES/SKIN: IMMEDIATELY FLUSH W/LARGE AMOUNTS OF WATER FOR 15 MINS. INGESTION: IMMEDIATELY DRINK LARGE AMOUNTS OF WATER. INDUCE VOMITING. DON'T GIVE ANYTHING BY MOUTH IF UNCONSCIOUS/CONVULSIVE. INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED. KEEP WARM & QUIET. OBTAIN MEDICAL ATTENTION IN ALL CASES.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE AREA/REMOVE IGNITION SOURCES/STOP SOURCE. AIR: SUPPRESS VAPORS W/WATER FOG. CONTAIN LIQUID FOR TREATMENT/ NEUTRALIZATION. WATER: SAFELY DIVERT WATER FLOW AROUND AREA. REMOVE W/ VACUUM SYSTEM/PUMPING DEVICE FOR TREATMENT/DISPOSAL. (SEE SUPP)
Neutralizing Agent: 5% CALCIUM HYPOCHLORITE AQUEOUS SOLUTION.
Waste Disposal Method: AS HAZARDOUS LIQUID WASTE, MUST BE DISPOSED OF IAW/FEDERAL, STATE & LOCAL REGULATIONS IN PERMITTED HAZARDOUS WASTE TREATMENT/STORAGE/DISPOSAL FACILITY BY INCINERATION. CONTAINERIZE & LABEL ALL SPILL MATERIALS PROPERLY. FLAMMABLE LIQUID UN1163.
Precautions-Handling/Storing: STORE IN WELL VENTILATED AREA AWAY FROM IGNITION SOURCES. DON'T STORE >124F, EXPOSE TO DIRECT LIGHT. MAINTAIN INERT ATMOSPHERE OVER SOLUTION ALWAYS.
Other Precautions: DON'T CONTAMINATE. CONTAINERS & HANDLING EQUIPMENT SHOULD BE ELECTRICALLY GROUNDED. RETEST MATERIAL >5 YEARS OLD BEFORE USE. AVOID CONTACT W/SKIN/EYES/CLOTHING. PACKAGE ONLY IN STAINLESS STEEL/ ALUMINUM/TEFLON/POLYETHYLENE.

Control Measures

Respiratory Protection: WEAR A NIOSH/MSHA APPROVED FULL FACE POSITIVE-PRESSURE SUPPLIED AIR RESPIRATOR IF ANY EXPOSURE OCCURS.
Ventilation: LOCAL EXHAUST TO MAINTAIN LEVELS <TLV.
Protective Gloves: BUTYL RUBBER
Eye Protection: SAFETY GLASSES & FACE SHIELD
Other Protective Equipment: BUTYL RUBBER BOOTS/APRON/PROTECTIVE SUIT, EYE WASH, SAFETY SHOWER.
Work Hygienic Practices: REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. WASH AFTER HANDLING. RINSE LEATHER ARTICLES W/WATER & DISCARD THEM.
Suppl. Safety & Health Data: PH (5% IN NEUTRAL DISTILLED WATER): 9.5-10.5. INCOMPATIBLES: METAL OXIDES/IRON/COPPER/MANGANESE/MOLYBDENUM/LEAD. SPILLS: LAND: DIKE. DILUE MATERIAL TO <30%/2 1/2 TO 1 WATER TO UDMH. DECONTAMINATE AREA BY DILUTING FURTHER W/WATER TO <5%. TEST FOR NEUTRALIZATION. SCRUB AREA W/STRONG DETERGENT & RINSE W/PLENTY OF WATER.

DOD Hazardous Materials Information System
DoD 6050.5-L
AS OF October 1995

SC: 9135
IIN: 007544614
anufacturer's CAGE: 1S133
art No. Indicator: A
art Number/Trade Name: NITRIC ACID,RED FUMING

General Information

tem Name: PROPELLANT,NITRIC ACID
ompany's Name: ATOMERGIC CHEMETALS CORP.
ompany's Street: 91 CAROLYN BLVD.
ompany's P. O. Box:
ompany's City: FARMINADALE
ompany's State: NY
ompany's Country:
ompany's Zip Code: 11735-1527
ompany's Emerg Ph #: 516-694-9000
ompany's Info Ph #:
istributor/Vendor # 1:
istributor/Vendor # 1 Cage:
istributor/Vendor # 2:
.stributor/Vendor # 2 Cage:
.stributor/Vendor # 3:
.stributor/Vendor # 3 Cage:
.stributor/Vendor # 4:
.stributor/Vendor # 4 Cage:
ıfety Data Action Code:
ıfety Focal Point: D
:cord No. For Safety Entry: 001
:c Safety Entries This Stk#: 001
.atus: SH
.te MSDS Prepared: 01MAR80
fety Data Review Date: 15NOV88
.pply Item Manager: SP
DS Preparer's Name:
eparer's Company:
eparer's St Or P. O. Box:
eparer's City:
eparer's State:
eparer's Zip Code:
her MSDS Number:
DS Serial Number: BFNNT
ecification Number: MIL-P-7254
ec Type, Grade, Class:
zard Characteristic Code: D1
it Of Issue: LB
it Of Issue Container Qty: BULK
pe Of Container: METAL TANK
t Unit Weight:

Report for NIIN: 007544614

NRC/State License Number:
Net Explosive Weight:
Net Propellant Weight-Ammo:
Coast Guard Ammunition Code:

Ingredients/Identity Information

Proprietary: NO
Ingredient: NITRIC ACID (SARA III)
Ingredient Sequence Number: 01
Percent: 52-86
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: QU5775000
CAS Number: 7697-37-2
OSHA PEL: 2 PPM/4 STEL
ACGIH TLV: 2 PPM/4 STEL; 9192
Other Recommended Limit: N/R

Proprietary: NO
Ingredient: NITROGEN DIOXIDE (SARA III)
Ingredient Sequence Number: 02
Percent: 13-46
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: QW9800000
CAS Number: 10102-44-0
OSHA PEL: C,5 PPM
ACGIH TLV: 3 PPM/5 STEL; 9293
Other Recommended Limit: N/R

Physical/Chemical Characteristics

Appearance And Odor: YELLOW TO RED BROWN, CLEAR, STRONGLY-FUMING LIQ
Boiling Point: 64.2C
Melting Point:
Vapor Pressure (MM Hg/70 F): 139
Vapor Density (Air=1): 1.58
Specific Gravity: 1.55
Decomposition Temperature:
Evaporation Rate And Ref: (BUAC = 1): <1
Solubility In Water: COMPLETE
Percent Volatiles By Volume: 14%
Viscosity:
pH:
Radioactivity:
Form (Radioactive Matl):
Magnetism (Milligauss): N/P
Corrosion Rate (IPY):
Autoignition Temperature:

eport for NIIN: 007544614

Fire and Explosion Hazard Data

Flash Point: NOT FLAMMABLE
Flash Point Method: N/P
ower Explosive Limit: N/R
upper Explosive Limit: N/R
Extinguishing Media: N/K
pecial Fire Fighting Proc: NOX MAY BE PRESENT FROM VENTED OR RUPTURED
ONTAINERS.
Unusual Fire And Expl Hazrds: IF WATER IS ADDED, VIOLENT SPATTERING CAN
CCUR. CONSIDERABLE HEAT IS EVOLVED WHEN CONTACTED W/WATER

Reactivity Data

tability: YES
ond To Avoid (Stability): INCREASING TEMP CAUSES MORE RAPID EVOLUTION OF
HE NOX.
aterials To Avoid: METALS/HYDROGEN SULFIDE/TURPENTINE/CARBIDES/ALKALIS/
LUORINE
azardous Decomp Products: TOXIC NITROGEN OXIDES WILL BE RELEASED.
azardous Poly Occur: NO
onditions To Avoid (Poly): BOILING CAUSES HAZARDOUS MIST(ACID/ OXIDIZING)
O BE EVOLVED.

Health Hazard Data

050-LC50 Mixture:
oute Of Entry - Inhalation: YES
oute Of Entry - Skin: YES
oute Of Entry - Ingestion: NO
alth Haz Acute And Chronic: ACID GASES OR MIST CAUSES SEVERE BURNS,CAN
FATAL IF INGESTED.
rcinogenicity - NTP: N/P
rcinogenicity - IARC: N/P
rcinogenicity - OSHA: N/P
planation Carcinogenicity: N/R
gns/Symptoms Of Overexp: SKIN, EYES, NOSE, LUNG, MOUTH, THROAT & UPPER
SPIRATORY SYSTEM IRRITATION; BURNS, CONJUNCTIVITIS
i Cond Aggravated By Exp:
ergency/First Aid Proc: SKIN/EYES: FLUSH W/WATER FOR AT LEAST 15 MINS.
OVE CONTAMINATED CLOTHING. INGESTION: DRINK MILK TO ACID. DON'T INDUCE
ITING. INHALATION: CARRY TO UNCONTAMINATED AREA/KEEP QUIET. GET PROMPT
ATT. EFFECTS OF INHALATION MAY BE DELAYED.

Precautions for Safe Handling and Use

ps If Matl Released/Spill: GOOD VENTILATION IS NECESSARY. PERSON
OSED SHOULD WEAR FULL PROTECTIVE EQUIPMENT.ILUTE SMALL SPILLS CAUTIOUSLY
LENTY OF WATER IF THE RESULTING SPATTERG & VIOLENT REACTION CAN BE
ELY CONTAINED, THEN NEUTRALIZED W/ALKALI.
tralizing Agent:
te Disposal Method: DISPOSAL OF RED FUMING NITRIC ACID MAY BE SUBJECT

Report for NIIN: 007544614

TO FEDERAL, STATE, & LOCAL REGULATIONS.
Precautions-Handling/Storing: STORE IN A WELL-VENTILATED, PROPERLY-DRAINED SITE, AWAY FROM HEAT & OUT OF SUN. PROTECT FROM PSICAL DAMAGE. DON'T BREATHE THESE GASES.
Other Precautions: AVOID INHALATION OF VAPORS OR MISTS & ALL BODILY CONTACT. KEEP AWAY FROM INCOMPATIBLE SUBSTANCES.

Control Measures

Respiratory Protection: RESPIRATORY APPROVED BY NIOSH FOR NITRIC ACID/ NITROGEN DIOXIDE GASES
Ventilation: ALL HANDLING SHOULD BE DONE IN A CLOSED VENTILATION.
Protective Gloves: NEOPRENE
Eye Protection: GLASSES/FACESHIELD/GOGGLE
Other Protective Equipment: DON'T WEAR CONTACT LENSES. FULL PROTECTIVE CLOTHING & BOOTS.
Work Hygienic Practices:
Suppl. Safety & Health Data: MSDS DATE: 03/80. SUPPLIER: ATOMERGIC CHEMETALS CORP, FARMINGDALE, NY.

AGENCIES AND PERSONS CONSULTED

The following Agencies and individuals were consulted for information used in the preparation of this Environmental Assessment:

Joel Alderete, Junior Environmental Scientist, Cortez III Environmental Department

David Anderson, Land Manager, WSMR Environmental Services Division

Doug Burkett, LRAM Coordinator, WSMR Environmental Services Division

Joe Gomez, Chemist, WSMR Chemistry Laboratory

Karen Hay, NEPA Coordinator, WSMR Environmental Services Division

Larry Kamees, Biological Field Technician, Cortez III Environmental Department

Scott Lerich, Junior Environmental Scientist, Cortez III Environmental Department

Jessie Martinez, Engineer Technician, MTD-AW

John Mills, Senior Environmental Scientist, Cortez III Environmental Department

Patrick Morrow, Game Manager, WSMR Environmental Services Division

Gretchen Norman, Environmental Scientist, Cortez III Environmental Department

Bob Stewart, Project Engineer, Lance Missile, WSMR

Robin Wilson, Chemist, MTD-AW

List of Acronyms

AQCR	Air Quality Control Regions
Army TACMS	Army Tactical Missile System
DES-E	Directorate of Environmental and Safety Environmental Services Division
EA	Environmental Assessment
EMR	Electromagnetic Radiation
EOD	Explosive Ordinance Disposal
EPA	Environmental Protection Agency
HWMF	Hazardous Waste Management Facility
IET	Initial Entry Team
IRFNA	Inhibiting Red Fuming Nitric Acid
kg	kilograms
km	kilometer
LANCE	Lance Missile
LC	Launch Complex
LM	Lance Marker
m	meter
MAB	Missile Assembly Building
mg/L	milligrams per liter
MTD-AW	Materiel Test Directorate - Warheads Test Branch
NASA	National Aeronautical Space Administration
NEPA	National Environment Policy Act
NMED	New Mexico Environment Department
OSHA	Occupational Safety and Health Act
PM_{10}	Particulate Matter small enough to inhale
POL	Petroleum, Oils, and Lubricants
REC	Record of Environmental Consideration
SOP	Standing Operating Procedure
SPGG	Solid Propellant Gas Generator
SWAB	Special Weapons Assembly Building
UDMH	Unsymmetrical Dimethylhydrazine
WIT	Weapons Impact Target
WSMR	White Sands Missile Range
^{o}C	degrees Celsius
^{o}F	degrees Fahrenheit

Appendix C

Standing Operating Procedure for Lance missile recovery

U.S. ARMY WHITE SANDS MISSILE RANGE
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002

WSMR SOP NO: MTD-AW-38-95
USADACS SOP NO: WS-CCCO-F-028
DATE: 13 Jun 95
REVISION: _____

STANDING OPERATING PROCEDURE FOR RECOVERY OF LANCE MISSILE

ORGANIZATION SYMBOL: STEWS-MTD-AW (WARHEADS TEST BRANCH)
AREA: LANCE LM IMPACT AREAS, MLRS IMPACT AREAS
PROPELLANT LIMITS: NOT TO EXCEED 145 LBS
HAZARD CLASSIFICATIONS/DIVISION: 1.3C
PERSONNEL LIMITS: 10 OPERATORS: 5 CASUALS: 5

PREPARED BY: Robin M. Wilson 5/10/95
ROBIN M. WILSON Date
Chemist, Warheads Engr & Assessment Section

REVIEWED BY:

John S. Bennett 5-10-95
JOHN S. BENNETT Date
Chief, Warheads Test Section

Richard D. Overley 5/18/95
RICHARD D. OVERLEY Date
Chief, Warheads Engineering & Assessment Section

SUBMITTED BY: Richard D. Overley 5/18/95
RICHARD D. OVERLEY Date
Acting Chief, Warheads Test Branch

CONCURRENCES:

OFFICE	SIGNATURE AND DATE	TITLE
DES-Q	Julian A. Hopper 13 Jun 95 JULIAN A. HOPPER	QASAS
Safety Division	Robert L. Peters 13 Jun 95 ROBERT L. PETERS	Chief
Environment & Safety Directorate	Thomas A. Ladd 13 Jun 95 THOMAS A. LADD	Director

APPROVED FOR THE COMMANDER
Robert M. Baker 13 Jun 95
ROBERT M. BAKER Date
Colonel, EN
Deputy Commander

U.S. ARMY WHITE SANDS MISSILE RANGE
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002

WSMR SOP NO: MTD-AW 34-95
USADACS SOP NO: WS-CCCO-F-0
DATE: 13 Jun 95
REVISION: _____

STANDING OPERATING PROCEDURE FOR RECOVERY OF LANCE MISSILE

ORGANIZATION SYMBOL: STEWS-MTD-AW (WARHEADS TEST BRANCH)
AREA: LANCE LM IMPACT AREAS, MLRS IMPACT AREAS
PROPELLANT LIMITS: NOT TO EXCEED 145 LBS
HAZARD CLASSIFICATIONS/DIVISION: 1.3C
PERSONNEL LIMITS: 10 OPERATORS: 5 CASUALS: 5

PREPARED BY: Robin M. Wilson 5/10/95
ROBIN M. WILSON Date
Chemist, Warheads Engr & Assessment Section

REVIEWED BY:

John S. Bennett 5-10-95
JOHN S. BENNETT Date
Chief, Warheads Test Section

Richard D. Overley 5/18/95
RICHARD D. OVERLEY Date
Chief, Warheads Engineering & Assessment Section

SUBMITTED BY: Richard D. Overley 5/18/95
RICHARD D. OVERLEY Date
Acting Chief, Warheads Test Branch

CONCURRENCES:

OFFICE	SIGNATURE AND DATE	TITLE
DES-Q	JULIAN A. HARPER	QASAS
Safety Division	ROBERT L. PETERS	Chief
Environment & Safety Directorate	THOMAS A. LADD	Director

APPROVED FOR THE COMMANDER

ROBERT M. BAKER Date
Colonel, EN
Deputy Commander

SUPERVISOR'S STATEMENT

WARHEADS TEST BRANCH
TEST SUPPORT DIVISION
MATERIEL TEST DIRECTORATE

SOP NO. MTD-AW 38-95 REV NO. ___ CHANGE NO. _____ DATE 13 Jun 95

1. The supervisor will sign this statement:

   a. When first assigned as supervisor of the operation.

   b. When an approved formal or interim change is made to the SOP.

   c. At lest once per quarter during continuing operations.

   d. After absence from job in excess of 15 consecutive work days.

2. I have personally reviewed each of the operational steps of the SOP and have no question in my mind that the operation can be performed safely, efficiently, and in an environmentally acceptable manner. I have trained the operators in the details of their part of the operation and have instructed them to follow the SOP without deviation. All personnel participating in ammunition/explosive operations are ammunition certified.

PRINT NAME	SIGNATURE	DATE	ORGAN	OP NO

USADACS SOP NO: MTD-AW 38-95
WSMR SOP NO: WS-0000-F-028
DATE: 13 Jun 95
REV: _____

STANDING OPERATING PROCEDURE
COMPLIANCE INSTRUCTIONS

This Standing Operating Procedure (SOP) must be complied with at all times. Changes or deviations from these procedures are not authorized unless written approval is granted by the Commander or his/her designated representative prior to performing an operation or task.

When this procedure does not cover specifically all requirements to perform the operation/task safely, the operation/task will cease until a change to the SOP has been written. Your supervisor and/or worker in charge will be immediately informed of all stoppages associated with this SOP.

All personnel when initially assigned to these operations will be trained thoroughly on the SOP and its changes involved in the operations covered by approved supplements to the SOP. All personnel will be required to affix their signature to the applicable signature sheet(s). Each time thereafter when the employee is assigned to perform the functions covered under this SOP, the employee will be thoroughly briefed by the responsible supervisor daily prior to start of the operations(s). The briefing will cover their responsibilities within the conduct of the SOP/SOP approved supplement. At this time, all approved changes/additions and safety requirements of the SOP will be thoroughly discussed with the employee(s) assigned to the task/operation.

All personnel assigned to perform functions covered by this SOP will sign the appropriate signature sheet.

All changes, SOP supplements, deviations or additional requirements must be fully coordinated with the following:

a. Test Director/Conductor responsible for task.
b. Worker in charge of the task.
c. Supervisor of all personnel involved.
d. Safety Division (SOP Coordinator).
e. Range operations when required by the Safety Division.
f. Environmental Services Division (when required).
g. Commander or his/her delegated representative.

OPERATOR'S STATEMENT

WARHEADS TEST BRANCH
TEST SUPPORT DIVISION
MATERIEL TEST DIRECTORATE

SOP NO. MTD-AW-38-95 REV NO. ___ CHANGE NO. ___ DATE 13Jun95

1. The operator will sign this statement:

   a. When first assigned to the operation.

   b. When an approved formal or interim change is made to the SOP.

   c. At lest once per quarter during continuing operations.

   d. After absence from job in excess of 15 consecutive work days.

2. I have read or have had read to me, and understand the general and specific safety, and environmental requirements, personnel and explosive limits, work description, and inspection requirements necessary to accomplish my operation. I have been thoroughly trained in, and I am familiar with my part of the operation, and I agree to abide by these instructions throughout my assignment to the operation. All personnel participating in ammunition/explosive operations must be ammunition certified.

PRINT NAME	SIGNATURE	DATE	ORGAN	OP NO:

WSMR SOP NO: MTD-AW-38-95
USADACS SOP NO: WS-0000-F-03
DATE: 13 Jun 95

GENERAL

1. This SOP covers the personnel safety precautions to be followed because each Lance missile motor contains 375.5 pounds of Unsymmetrical Dimethylhydrazine (UDMH) and 1106.5 pounds of Inhibited Red Fuming Nitric Acid (IRFNA).

2. The impact sites covered by this SOP include but are not restricted to the LANCE LM IMPACT POINTS.

3. Safety requirements in AMCR 385-100 and DA PAM 385-64 will be followed.

4. The Initial Entry Team (IET) will consist of members from MTD-AW. The propellant monitoring equipment operator will be the IET Chief.

WARNING

The propellants used by the LANCE missile motor, UDMH and IRFNA, are hazardous. Proper safety precautions must be observed during all operations.

5. On the day of the firing, the missile impact crater area will not be entered. There will be a twenty-four (24) hour venting period to allow the residual propellant to dissipate from the impact area, however; if the missile firing is abnormal (i.e. the missile impact is long or short, or the missile hits the road) go to step 7.

6. The IET will locate the impact from the helicopter and instruct the pilot to land a safe distance from the impact area. The area will be staked and mark so that the IET team can return to the site the following day to complete the necessary recovery/cleanup operation.

7. An assessment of the conditions existing in the immediate area surrounding the missile impact site must be made by the IET to determine what safety restrictions exist with respect to the presence of UDMH and IRFNA prior to initiating any cleanup/recovery operations. The IET will alert all necessary personnel and the following safety precautions will be taken.

a. The area will be monitored for residual propellant continuously with Interscan Monitors.

b. Any action taken will be cleared first with MTD-AW, EOD, and Recovery.

c. Respiratory apparatus will be used as the guidelines in Appendix A dictate.

CAUTION

Stay upwind of the motor impacts whenever possible. Allow ample time for the motor to cool and the fuel residue to dissipate prior to working the impact site.

CLEANUP/RECOVERY OPERATIONS

THE DAY AFTER THE MISSILE FIRING:

1. The IET will sample the air for the levels or presence of UDMH and IRFNA throughout the entire recovery/cleanup operation.

2. The IET will enter the missile impact area to conduct an initial assessment of the area and the debris for UDMH and IRFNA and to establish a safe standoff point.

3. The IET will set up a safe standoff point upwind of the impact site, assuring that personnel utilize proper protective clothing and equipment.

4. Only when the concentration of UDMH and IRFNA is not detectable will the IET allow the recovery/cleanup crew to perform their recovery/cleanup operations.

5. Throughout the recovery/cleanup operation, selected warhead debris may be recovered by project personnel and retained for analysis.

NOTE
PLASTICS SHOULD BE EXCLUDED FROM RECOVERY IF POSSIBLE

7. The debris collected for recovery will be placed in an approved container for transportation to SWAB-5.

8. All other debris will be collected, placed in the missile crater, and covered with dirt upon the completion of this operation.

9. At the end of this operation the missile crater will be left open for six months. At the end of six months, the missile crater will be filled in with dirt, the surface smoothed over and the entire area returned to as close to its original condition as possible.

10. The IET will monitor all surface areas, personnel and equipment for residual UDMH and IRFNA contamination upon completion of the cleanup.

INSPECTION REQUIREMENTS

1. The IET will monitor the missile impact site prior to any debris cleanup or collection.

2. All personnel, vehicles and equipment will be monitored for UDMH and IRFNA upon exit from the missile impact site or as directed by the IET Chief.

3. Ensure only authorized personnel handle the submunitions. Government employees must have a current Ammunition and Explosive Certification Card (STEWS-MTD Form 204 or equivalent).

SAFETY REQUIREMENTS

1. No personnel will enter the missile impact area without proper protective clothing and equipment as directed by the IET Chief.

2. All personnel will be monitored upon exit of the missile impact site.

3. All personnel will wash hands, face and neck areas prior to eating, drinking and/or smoking after they have been in the missile impact area.

4. Personnel not required to assist in any cleanup/recovery operations will remain at the standoff point.

5. All recovered debris will be monitored for UDMH and IRFNA contamination.

6. Hard hats and safety shoes will be worn by all personnel working in the missile impact area during any excavation/recovery of missile debris.

EQUIPMENT REQUIREMENTS

1. Breathing Apparatus
2. Butyl rubber gloves or equivalent
3. Disposable coveralls
4. MMH Interscan meter
5. NO_2 Interscan meter
6. Water spraying devices
7. Water containers (for washing) (10 gallon minimum)
8. Safety Shoes
9. Hard hats
10. Storage containers

DISPOSITION OF COMPONENTS AND MATERIAL

The recovered debris will be transported to SWAB-5 prior to any further disposition.

EMERGENCY PROCEDURES

In the event of an emergency or incident involving personnel injury, the gravity of the situation will be assessed by the person in charge. If medical attention is required, contact the following organizations:

1. McAfee Medical Clinic: 678-1403/2882
   116 for Ambulance
   911

2. Safety Office: 678-1211/1213

3. Fire Department: 117

4. Military Police: 678-1234

5. Warheads Test Branch: 678-5400

6. QASAS: 678-3921

APPENDIX A

1. If a Lance impact area needs to be entered immediately after a firing, then full Personal Protection Equipment (PPE) will be utilized. The PPE will consist of coveralls and gloves made of resistant materials such as butyl, chlorobutyl, or neoprene. A Self Contained Breathing Apparatus (SCBA) will be used.

2. Once the concentrations of propellants is less than [illegible] gas mask such as Mine Safety Appliances Company (MSA) with canisters that protect against IRFNA and UDMH will be utilized.

3. When no UDMH or IRFNA is detectable in the entire impact area, work can proceed without the use of a breathing apparatus.

4. During all activities (recovery, cleanup, restoration, etc.) the area will be continuously monitored.

5. All personnel working in the impact area will be properly trained in the use of respiratory equipment and of the dangers of UDMH and IRFNA.

JOB HAZARD ANALYSIS	JOB TITLE/OPERATION: LANCE MISSILE IMPACT RECOVERY PROCEDURES	9 May 1995

SPECIAL EQUIPMENT REQUIREMENTS: UDMH INTERSCAN METER, INTERSCAN METER, SELF CONTAINED BREATHING APPARATUS

BASIC JOB STEPS	EXISTING/POTENTIAL HAZARD	RISK	CORRECTIVE MEASURE	RISK
1. Monitoring impact crater for residual propellant.	1. Toxic poisoning from exposure to high levels of propellant residue.	III-C 4	1. Read MSDS for propellants. Use proper protective clothing and respiratory equipment as required by this SOP while performing task if indicated by readings of UDMH or NO2 meters.	III-E 5
2. Cleanup and recovery debris around impact crater.	2. Same as 1.	III-C 4	2. Same as 1.	III-E 5

Robin M. Wilson

PREPARED BY: ROBIN M. WILSON

Richard D. Overley

REVIEWED BY: RICHARD D. OVERLEY

STOCK NUMBER	MFG FSCM	PN IND	PP IND	STATUS	NO ENTRIES
9135-00-687-4295	53084	A	F		001 OF 001

PART NO/TRADE NAME CPEI34072 UNSYMMETRICAL DIMETHYLHYDRAZINE
SAFETY FILE ACTION CODE
DATE MDS PREPARED 01JAN91
DATE OF TECH REVIEW 19MAR92
SUPPLY ITEM MANAGER

GENERAL INFORMATION

ITEM NAME	HYDRAZINE
MANUFACTURE NAME	OLIN CORPORATION
STREET	120 LONG RIDGE ROAD
P O BOX	N/K
CITY	STAMFORD
STATE	CT
ZIP	06904
EMER PHONE	(203) 356-3449
INF PHONE	(203) 356-3449
COMPANY	OLIN CORPORATION
STREET	120 LONG RIDGE ROAD
CITY	STAMFORD
STATE	CT
ZIP	06904
SPECIFICATION NO	MIL-P-25604
TYPE	
HAZ STRG COMPAT CODE	F6-F2
UNIT OF ISSUE	
CONTAINER QUANTITY	
CONTAINER TYPE	METAL
NET UNIT WEIGHT	

INGREDIENTS INFORMATION

NO 01 NIOSH	HZ2450000
CAS NUMBER	57-14-7
INGREDIENTS	1,1-DIMETHYLHYDRAZINE, UDMH
	INTENDED CHANGE (IC)
PERCENT	95-99%
OSHA PEL	1 MG/CUM
ACGIH TLV	0.025 MG/CUM IC (A2)
RECOMMENDED LIMIT	0.5 PPM
PROPRIETARY	NO
NO 02 NIOSH	IP8750000
CAS NUMBER	124-40-3
INGREDIENTS	DIMETHYLAMINE
PERCENT	1-5%
OSHA PEL	18 MG/CUM
ACGIH TLV	18 MG/CUM
RECOMMENDED LIMIT	10 PPM
PROPRIETARY	NO
NO 03 NIOSH	ZC0110000
CAS NUMBER	7732-18-5
INGREDIENTS	WATER, H2O
PERCENT	0.1-1%
OSHA PEL	N/K
ACGIH TLV	N/K
RECOMMENDED LIMIT	N/K
PROPRIETARY	NO

PHYSICAL/CHEMICAL CHARACTERISTICS

MELTING POINT	-7.7F
VAPOR PRESSURE	157 MM HG
VAPOR DENSITY	2.1
SPECIFIC GRAVITY	0.79
DECOMPOSITION TEM	700F
EVAPORATION RATE	N/K
SOLUBILITY IN WATER	COMPLETE
PCT VOLATILIES BY VOL	100%
PH	7.0
CORROSION	N/K

****

FIRE AND EXPLOSION HAZARD DATA

****

FLASH POINT	3F
FLASH POINT METHOD	COC
LOWER EXPLOSIVE LIMIT	2%
UPPER EXPLOSIVE LIMIT	95%
EXTINGUISHING MEDIA	CO2, DRY CHEMICAL, OR WATER SPRAY
SPEC FIRE FIGHT PROCED	USE WATER TO COOL CONTAINERS EXPOSED TO FIRE. WEAR SELF-CONTAINED BREATHING APPARATUS POSITIVE PRESSURE UNIT.
UNUS FIRE & EXPLOS HAZ	N/K

****

REACTIVITY

****

STABILITY	YES
COND TO AVOID (STABIL)	HEAT, SPARKS, & OPEN FLAME
MATERIALS TO AVOID	STRONG OXIDIZERS SUCH AS HYDROGEN PEROXIDE/NITROGEN TETROXIDE/FLUORINE/HALOGNE FLUORIDES/FUMING NITRIC ACID. SEE SUPP.
HAZ DECOMPOSITION PROD	CO, & NITROGEN OXIDES
HAZ POLYMERIZATN OCCUR	NO
COND TO AVOID (POLYMR)	N/K

****

HEALTH HAZARD

****

LD50 OR LC50 MIXTURE	ORAL LD50 (RAT): 122 MG/KG
ROUTE OF ENTRY - INHAL	YES
- SKIN	YES
- INGEST	YES
HEALTH HAZ ACUTE-CHRONIC	INHALATION: NOSE/THROAT/UPPER RESPIRATORY TRACT/LUNG IRRITATION/BRONCHITIS/PULMONARY EDEMA/LIVER/KIDNEY/BLOOD/LUNG DAMAGE/FATAL. SKIN: IRRITATION/BURN. EYE: INFLAMMATION/SWELL/REDNESS/DISCHARGE. INGESTION: GASTROINTESTINAL TRACT/STOMACH/INTESTINE IRRITATION/NAUSEA/VOMITING/DIARRHEA/ABDOMINAL PAIN/BLEEDING/ABSORPTION.

CARCINOGENICITY - NTP	NO
- IARC	NO
- OSHA	NO
EXPLANATION	NONE
SIGNS & SYMPTOM OF EXPO	INHALATION:
MEDICAL CONDITIONS GEN AGGRAVATED BY EXPOSUR	LIVER, KIDNEY, BLOOD DISEASES AS WELL AS ASTHMA & CARDIOVASCULAR DISEASE.

EMERGENCY AND FIRST AID EYE(SKIN): FLUSH W/PLENTY OF WATER FOR AT LEAST 15

	IF BREATHING DIFFICULT, GIVE OXYGEN. ENSURE [illegible] VENTILATION. OBTAIN MEDICAL ATTENTION IN ALL CASES.

PRECAUTIONS FOR SAFE HANDLING AND USE

TEPS TO BE TAKEN IF	LIVER, KIDNEY, BLOOD DISEASES AS WELL AS ASTHMA & CARDIOVASCULAR DISEASE.
HAT IS RELEASED/SPILL	REMOVE ALL IGNITION SOURCES. STOP SPILL AT SOURCE AS SOON AS POSSIBLE. CONTAIN LIQUID FOR TREATMENT/NEUTRALIZATION. REMOVE W/VACUUM SYSTEM/PUMPING DEVICE. LAND SPILL: DIKE/DILUTE TO BRING CONCENTRATION OF USMM <30% & REMOVE AS LIQUID/CONTAINERIZE.
EUTRALIZING AGENT	ADD WATER TO 5% OR <SOLUTION. ADD EQUAL VOLUME OF 5% CALCIUM HYPOCHLORITE.
ASTE DISPOSAL METHOD	DON'T ALLOW TO DRY COMPLETELY. AS HAZARDOUS LIQUID WASTE IN ACCORDANCE W/LOCAL, STATE, & FEDERAL REGULATIONS IN PERMITTED HAZARDOUS WASTE TREATMENT STORAGE, & DISPOSAL FACILITY BY INCINERATION.
ANDLING/STORAGE PREC	STORE IN WELL-VENTILATED AREA. DON'T CONTAMINATE. ELECTRICALLY GROUND ALL CONTAINER/HANDLING EQUIPMENT. DON'T STORE >124F.
THER PRECAUTIONS	DON'T EXPOSE TO DIRECT LIGHT. STABLE FOR AT LEAST ONE YEAR IF STORED UNDER NITROGEN & TIGHTLY SEALED TO EXCLUDE AIR.

CONTROL MEASURES

ESPIRATORY PROTECTION	USE NIOSH/MSHA APPROVED RESPIRATOR.
ENTILATION	LOCAL EXHAUST TO KEEP <TLV. TLV
ROTECTIVE GLOVES	BUTYL RUBBER
/E PROTECTION	FACE SHIELD W/SAFETY GLASSES
TH PROTECTIVE EQUIP	BUTYL RUBBER BOOTS, APRON & PROTECTIVE IMPERMEABLE SUIT. EYE WASH & SAFETY SHOWER.
DAY HYGENIC PRACTICES	REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE USE. DISCARD CONTAMINATED LEATHER ARTICLES.
UPPLEMENTAL SAFETY AND HEALTH DATA	MATERIAL TO AVOID: MOLYBDENUM CONTAINING [illegible] AS HASTELLOY C & COPPER CONTAINING ALLOYS. [illegible] OXIDES, ABSORPTION OF 1,1-DIMETHYL HYDRAZINE BY PORTS COTTON WASTE, SAWDUST, OR SIMILAR ORGANIC [illegible]

TRANSPORTATION DATA

ATE OF RECORD	87060
OT PSN CODE	FBN
SHIPPING NAME	DIMETHYLHYDRAZINE,UNSYMMETRICAL
HAZARD CLASS	FLAMMABLE LIQUID
LABEL	FLAMMABLE LIQUID AND POISON
MODE OF TRANSPORTAT	
ID NUMBER	UN1163
MO PSN	FLH
SHIPPING NAME	UNS DIMETHYLHYDRAZINE
IMDG PAGE NUMBER	SEE 3072
UN NUMBER	1163
CLASS	3.2

```
      SHIPPING NAME
      UN CLASS              N/R
      SUBSID RISK CLASS     N/R
      LABEL                 N/R
      UN ID NUMBER          N/R
ARF 71-4 PSN                ZZY
         SHIPPING NAME      FORBIDDEN BY THIS MODE OF TRANSPORTATION
         HAZARD CLASS
         LABEL
         ID NUMBER
ADDITIONAL TRANSP DATA  MARK CONTAINER INHALATION HAZARD
DO YOU WANT USASC TO MAIL A COPY OF THESE DATA SHEETS (Y)ES  (N)O
```

PRINT ALL SHEETS OR TYPE SELECTED NSN (ALL
A

01/22/93 PAGE 1

		PH (N)	FF (N)	STATUS	NO CHRGS
	DOWEL	A	F		001 OF 001

PART NO/TRADE NAME: INHIBITED RED FUMING NITRIC ACID (RFNA
SAFETY FILE ACTION CODE
DATE MSDS PREPARED: 10JUN87
DATE OF TECH REVIEW: 18NOV88
SUPPLY ITEM MANAGER

GENERAL INFORMATION

MANUFACTURE NAME: DOWELL SCHLUMBERGER
STREET: N/K
P O BOX: 21
CITY: TULSA
STATE: OK
ZIP: 74102
EMER PHONE: (918) 582-0104
INF PHONE: (918) 582-0104
MSDS PREPARER NAME: W. W. SHEPHERD
COMPANY: DOWELL SCHLUMBERGER
STREET: N/K
CITY: TULSA
STATE: OK
ZIP: 74102
UNIT OF ISSUE
CONTAINER QUANTITY 1 DI
CONTAINER TYPE
NET UNIT WEIGHT

INGREDIENTS INFORMATION

NO 01 NIOSH: QU5775000
CAS NUMBER: 7697-37-2
INGREDIENTS: NITRIC ACID (SARA III)
PERCENT: N/K
OSHA PEL: 2 PPM/4 STEL
ACGIH TLV: 2 PPM/4 STEL; 1992
RECOMMENDED LIMIT: N/K
PROPRIETARY: NO

NO 02 NIOSH: QW9650000
CAS NUMBER: 10102-44-0
INGREDIENTS: NITROGEN DIOXIDE (SARA III)
PERCENT: N/K
OSHA PEL: 1 PPM STEL
ACGIH TLV: 3 PPM/5 STEL; 1992
RECOMMENDED LIMIT: N/K
PROPRIETARY: NO

NO 03 NIOSH: QX1575000
CAS NUMBER: 10544-72-6
INGREDIENTS: NITROGEN DIOXIDE (SARA III)
PERCENT: N/K
OSHA PEL: NOT ESTABLISHED

ACGIH TLV: NOT ESTABLISHED
RECOMMENDED LIMIT: N/K
PROPRIETARY: NO

NO 04 NIOSH: HM7875000
CAS NUMBER: 7664-39-3
INGREDIENTS: HYDROGEN FLUORIDE (SARA III)

APPEARANCE AND ODOR	RED LIQUID WHICH EMITS YELLOWISH RED TOXIC FUMES OF NO
BOILING POINT	140F
MELTING POINT	-61F
VAPOR PRESSURE	0
VAPOR DENSITY	>1
SPECIFIC GRAVITY	1.6
DECOMPOSITION TEM	N/R
EVAPORATION RATE	N/R
SOLUBILITY IN WATER	100%
PCT VOLATILIES BY VOL	100%
PH	N/R
CORROSION	N/R

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT	NONE
FLASH POINT METHOD	NONE
LOWER EXPLOSIVE LIMIT	N/R
UPPER EXPLOSIVE LIMIT	N/R
EXTINGUISHING MEDIA	WATER. AFTER DILUTION WITH WATER OTHER EXTINGUISHING AGENTS MAY BE USED.
SPEC FIRE FIGHT PROCED	SCBA & SPECIAL RESISTANT SUIT MUST BE WORN.
UNUS FIRE & EXPLOS HAZ	N/R

REACTIVITY

STABILITY	YES
COND TO AVOID (STABIL)	N/R
MATERIALS TO AVOID	CAN REACT EXPLOSIVELY W/REDUCING AGENTS. REACTS VIGOROUSLY W/MANY ORGANIC MATERIALS INCLUDING CYCLOHEXANE, FORMALDEHYDE.
HAZ DECOMPOSITION PROD	TOXIC FUMES OF NOX AND HF.
HAZ POLYMERIZATN OCCUR	NO
COND TO AVOID (POLYMR)	REACTS WITH MANY METALS & ALCOHOLS

HEALTH HAZARD

LD50 OR LC50 MIXTURE	N/R
ROUTE OF ENTRY - INHAL	YES
- SKIN	YES
- INGEST	YES
HEALTH HAZ ACUTE-CRONIC	INHALATION: TOXIC. VERY DANGEROUS/POOR WARNING PROPERTIES/MAY CAUSE COUGHING/DIFFICULT BREATHING/PULMONARY EDEMA/DEATH. SKIN: DESTROYS TISSUE BY DIRECT ACTION. CAUSES BURNS. STAINS SKIN/TISSUE YELLOW OR YELLOWISH BROWN. EYES: CAUSES BURNS/PERMANENT LOSS OF VISION. INGESTION: BURNING/CORROSION OF MOUTH & DEATH.
CARCINOGENICITY - NTP	NO
- IARC	NO
- OSHA	NO
EXPLANATION	NONE
SIGNS & SYMPTOM OF EXPO	EFFECTS OF EXPOSURE MAY BE DELAYED. KEEP PATIENT AT REST & UNDER SURVEILLANCE A MINIMUM OF 72 HOURS. ADMINISTER OXYGEN IF BREATHING IS DIFFICULT. ORAL:

	INDIVIDUAL REACTIONS OF THE PATIENT, NO SPECIFIC ANTIDOTE.
MEDICAL CONDITIONS GEN AGGRAVATED BY EXPOSUR	N/R
EMERGENCY AND FIRST AID	EYES: FLUSH WITH WATER FOR 30 MINS. SEE PHYSICIAN. SKIN: FLUSH W/WATER FOR 30 MIN WHILE REMOVING CONTAMINATED CLOTHING. SEE PHYSICIAN. DESTROY CONTAMINATED CLOTHES & SHOES. INHALATION: REMOVE TO FRESH AIR. TRANSPORT TO HOSPITAL. KEEP PATIENT AT REST EVEN IF NO SYMPTOMS ARE EVIDENT. START ARTIFICIAL RESPIRATION IF BREATHING HAS STOPPED. INGESTION: DRINK LARGE MTS OF WATER. SEE PHYSICIAN.

PRECAUTIONS FOR SAFE HANDLING AND USE

STEPS TO BE TAKEN IF MAT IS RELEASED/SPILL	N/R CONTAIN, RECOVER, PREVENT CONTACT W/OXIDIZABLE MATERIALS. CAREFULLY DILUTE UNRECOVERABLE MATERIAL W/EXCESS WATER. PLACE IN SUITABLE CONTAINER. IF LARGE AMOUNT OF FUMES ARE GENERATED, PERSONNEL EVACUATION MAY BE REQUIRED.
NEUTRALIZING AGENT	N/R
WASTE DISPOSAL METHOD	DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL REGULATIONS. THIS IS A RCRA HAZARDOUS WASTE.
HANDLING/STORAGE PREC	STORE IN COOL WELL VENTILATED AREA AWAY FROM REDUCING AGENTS & COMBUSTIBLE MATERIALS.
OTHER PRECAUTIONS	N/K

CONTROL MEASURES

RESPIRATORY PROTECTION	WEAR RESISTANT SCBA.
VENTILATION	LOCAL & GENERAL VENTILATION IS REQUIRED
PROTECTIVE GLOVES	RECOMMENDED
EYE PROTECTION	RESISTANT FULL MASK
OTH PROTECTIVE EQUIP	WEAR SPECIAL RESISTANT FULL BODY COVERING.
WORK HYGIENIC PRACTICES	N/R
SUPPLEMENTAL SAFETY AND	

TRANSPORTATION DATA

DATE OF RECORD	01187
DT PEN CODE	111
SHIPPING NAME	NOT REGULATED FOR THIS MODE OF TRANSPOR
HAZARD CLASS	N/R
LABEL	N/R
MODE OF TRANSPORTAT	
ID NUMBER	N/R
MD PEN	111
SHIPPING NAME	NOT REGULATED FOR THIS MODE OF TRANSPORTATION
IMDG PAGE NUMBER	N/R
UN NUMBER	N/R
CLASS	N/R
SUBSID RISK LABEL	N/R
ATD PEN CODE	111
SHIPPING NAME	NOT REGULATED BY THIS MODE OF TRANSPORTATI
UN CLASS	N/R
SUBSID RISK LABEL	N/R

```
          LABEL              N/A
          ID NUMBER          N/A
ADDITIONAL TRANSP DATA  0 EACH CONTAINERS
YOU HAVE PRINTED     1 DATA SHEETS OF     2
DO YOU WISH USASC TO MAIL ALL SELECTED SHEETS  (N)
          TO CONTINUE                          (Y)
          TO STOP                              (S)
```

UNCLASSIFIED

OPERATIONAL HAZARDS

1. DATE: 25 Aug 89			
2. PROGRAM TITLE: LANCE Stockpile Flight Test/ Annual Service Practice	3. VEHICLE NAME: LANCE Main Missile Assemblage	4. OR NUMBER: 128/148	5. TEST DSG: All
6. SERIAL NUMBER: TE-L-LA-25	7. LAUNCH LOCATION: Approved Lance Launch Sites	8. IMPACT LOCATION: Approved Impact Areas	

9. ITEM	10. ITEM DESCRIPTION				11. LOCATION
1	IRFNA	Allied Chem Co.	2% H_2O 84.6% HNO_3 13.4% N_2O_2	1122 Liquid	Propulsion Sect.
2	UDMH	F.M.C. Corp.	$(CH_3)_2N_2H_2$	326 Liquid	Propulsion Sect.
3	SPGG	Olin Mathison	A G J	49 Solid	Propulsion Sect.
4	SQIBS	Spec Devices, Inc. Hi Shear	Electro/Pyro	- - - - -	Propulsion Sect.
5	IGNITER	Olin Mathison	Electro/Pyro	2 Solid	Propulsion Sect.

12.

ITEM 1: Detrimental to health through physical contact or inhalation of fumes. Ref: "The Handling and Storage of Liquid Propellants", Jan 63; Chap 14.

ITEM 2: Detrimental to health through physical contact or inhalation of fumes. Flammable in air over a wide range of concentrations. (2.5 to approx. 95.0 percent by volume.) Autoignition in air is 482°F. Ref: "Handling and Storage of Liquid Propellants," Jan 63; Chap 22.

ITEM 3, 4 & 5: Are not dangerous in the installed configuration unless inadvertent ignition occurs. With anti-propulsion device in the "ARM" position, the missile would become propulsive if ignition occurred. With the anti-propulsion device (APD) in the "SAFE" position, and ignition occurring; SPGG gasses would exit from the hot gas relief tubes (2) in forward sides of propulsion section and UDMH will be expelled from the rocket nozzle. If the SPGG ignites with the APD in the "SAFE" position the resultant torque developed could possibly cause the missile to spin or roll (fall) off of the launcher.

13. RADIOACTIVE HAZARDS

a. Is radioactive material used in this test? (Answer Yes or No) No .
b. If 13a is Yes, is the use of the materials governed by NASC procedures? _____
c. If 13b is Yes, the quantity of material is in Category _____ (A, B, or C).
d. If in Category A, has a Safety Summary been forwarded to (Answer Yes or No) Agency Contact _____. WSMR Safety Office _____.
e. If in Category B, was (Answer Yes or No to the following):
(1) It included in the Quarterly Tabular List? _____
(2) A copy of the Quarterly Tabular List forwarded to: Agency Contact _____; WSMR Safety Office _____?
(3) A Safety Summary for its use forwarded to WSMR Safety Office _____?

14. THE HAZARDS LISTED ABOVE ARE DESCRIBED COMPLETELY AND THERE ARE NO OTHER HAZARDOUS CONDITIONS ASSOCIATED WITH THIS TEST OPERATION.

James R. Moore 1 Sep 89
JAMES R. MOORE, Lance Test Conductor
Test Conductor — Date

HARRY L. MURRAY, Lance Project Engineer 7 Sep 89
Range Sponsor — Date

UEWS NR-P FORM 1
9 Jul 78 (Rev)

UNCLASSIFIED

PREVIOUS EDITIONS WILL NOT BE USED

Appendix D

Listed plant and animal species occurring on WSMR

FEDERALLY LISTED PLANT SPECIES

ENDANGERED

Hedeoma todsenii - Todsen's pennyroyal

SPECIES OF CONCERN

Cereus greggii var. *greggii* - night-blooming cereus
Oenothera organensis Organ Mountain evening primrose
Polygala rimulicola var. *mescalerorum* - Mescalero milkwort
Penstemon alamosensis - alamo beard-tongue

STATE LISTED SPECIES

ENDANGERED (List 1)

Cereus greggii var. *greggii* - night blooming cereus
Escobaria organensis - Organ Mountain pincushion cactus
Hedeoma todsenii - Todsen's pennyroyal
Polygala rimulicola var. *mescalerorum* - Mescalero milkwort

RARE AND SENSITIVE (List 2)

Agastache cana - mosquito plant
Apacheria chiricahuensis - cliff brittlebrush
Astragalus castetteri - Castetter's milkvetch
Escobaria sandbergii - Sandberg's pincushion cactus
Eustoma exaltatum - prairie gentian
Hedeoma pulcherrium - Mescalero pennyroyal
Oenothera organensis - Organ Mountain evening primrose
Penstemon alamosensis - alamo beard-tongue
Pseudocymopterus longiradiatus - desert parsley
Silene plankii - Plank's catchfly
Talinum longipes - flame flower

THREATENED AND ENDANGERED WILDLIFE OCCURRING OR POTENTIALLY OCCURRING ON WHITE SANDS MISSILE RANGE, NEW MEXICO

FEDERALLY LISTED SPECIES

CANDIDATE SPECIES:

Accipiter gentilis - northern goshawk
Ammodramus bairdii - Baird's sparrow
Buteo regalis - ferruginous hawk
Charadrius montanus - mountain plover
Plegadis chihi - white-faced ibis
Speotyto cunicularia hypugea - western burrowing owl
Phrynosoma cornutum - Texas horned lizard
Cynomys ludovicianus arizonensis - Arizona black-tailed prairie dog
Euderma maculatum - spotted bat
Eumops perotis californicus - greater western mastiff bat
Eutamias quadrivittatus australis - Organ Mountain Colorado chipmunk
Myotis lucifugus occultus - occult little brown myotis
Myotis velifer brevis - southwestern cave myotis
Neotoma micropus leucophaeus - White Sands Woodrat
Sigmodon fulviventor goldmani - Hot Springs cotton rat
Zapus hudsonius luteus - New Mexico meadow jumping mouse

THREATENED SPECIES

Strix occidentalis lucida - Mexican spotted owl

ENDANGERED SPECIES

Empidonax traillii extimus - southwestern willow flycatcher
Falco femoralis septentrionalis - northern aplomado falcon
Haliaeetus leucocephalus - bald eagle
Sterna antillarum athalassos - interior least tern
Canis lupus baileyi - Mexican gray wolf

STATE LISTED SPECIES

THREATENED SPECIES

Ammodramus bairdii - Baird's sparrow
Ammodramus savannarum ammolegus - Arizona grasshopper sparrow
Buteogallus anthracinus anthracinus - common black-hawk
Calypte costae - Costa's hummingbird
Empidonax traillii extimus - southwestern willow flycatcher
Haliaeetus leucocephalus - bald eagle
Passerina versicolor - varied bunting

Phalacrocorax brasiliensis (*olivaceous*) - neotropic (olivaceous) cormorant
Pipilo aberti aberti - Abert's towhee
Vireo bellii - Bell's vireo
Vireo vicinior - gray vireo
Crotalus lepidus lepidus - mottled rock rattlesnake
Euderma maculatum - spotted bat
Eutamias quadrivittatus australis - Organ Mountain Colorado chipmunk
Zapus hudsonius luteus - New Mexico meadow jumping mouse

ENDANGERED SPECIES

Falco femoralis septentrionalis - northern aplomado falcon
Falco peregrinus anatum - American peregrine falcon
Falco peregrinus tundrius - Arctic peregrine falcon
Sterna antillarum athalassos - interior least tern
Canis lupus baileyi - Mexican gray wolf
Ovis canadensis mexicana - desert bighorn

Appendix E

Calculations for estimated emissions produced by daily commuters to WSMR

Calculations for estimating gallons of gasoline utilized by commuters
WSMR Daily Commuters 8,801 personnel (WSMR Fact Sheet 1992) 2,200 vehicles required (assuming 4 people per vehicle) 60 mile round trip per day (assuming all personnel live in Las Cruces which is the closest city) 132,015 total miles travel per day by total commuters 4,400 total gallons of gas consumed per day by total commuters (assuming vehicles average 30 miles per gallon) 60 work days per year Estimated gallons consumed by the total commuters for one year: **4,400 X 260 = 1,144,000 gallons gasoline** Estimated gallons consumed by total commuters for five years: **1,144,000 X 5 years = 5,720,00 gallons gasoline**

Conversion factors for estimating emission quantities of selected pollutants.						
Source	Carbon Monoxide		Hydrocarbons		Nitrous Oxides	
	Kg/L	Lbs/gal	Kg/L	Lbs/gal	Kg/L	Lbs/gal
Gasoline	0.69	1.2	0.05	0.09	0.09	0.15
Diesel	0.17	0.29	0.03	0.05	0.12	0.21
JP4 (per hour)	2.04	3.50	0.17	0.30	5.03	8.64

Appendix F

Safety Zones Associated with Lance missile system

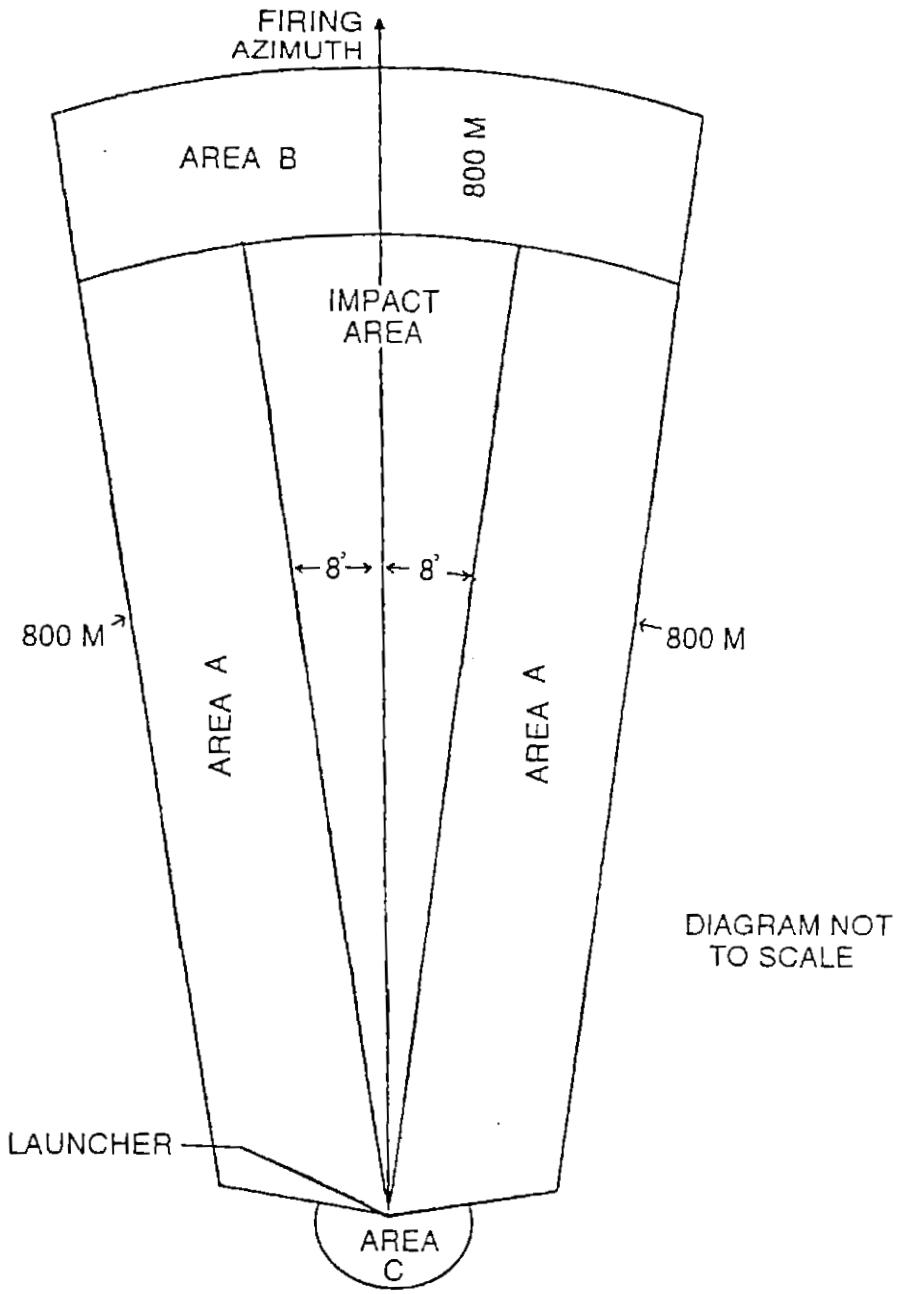
Area A - Lateral Danger Area
This area parallels each side of the impact area. The outer boundary of this area is at a distance of 800 m from the 8^0 fan outer boundary to the right and left of the firing azimuth and extends to the maximum possible range. This area is considered adequate to contain the impact of any errant missiles and associated debris.

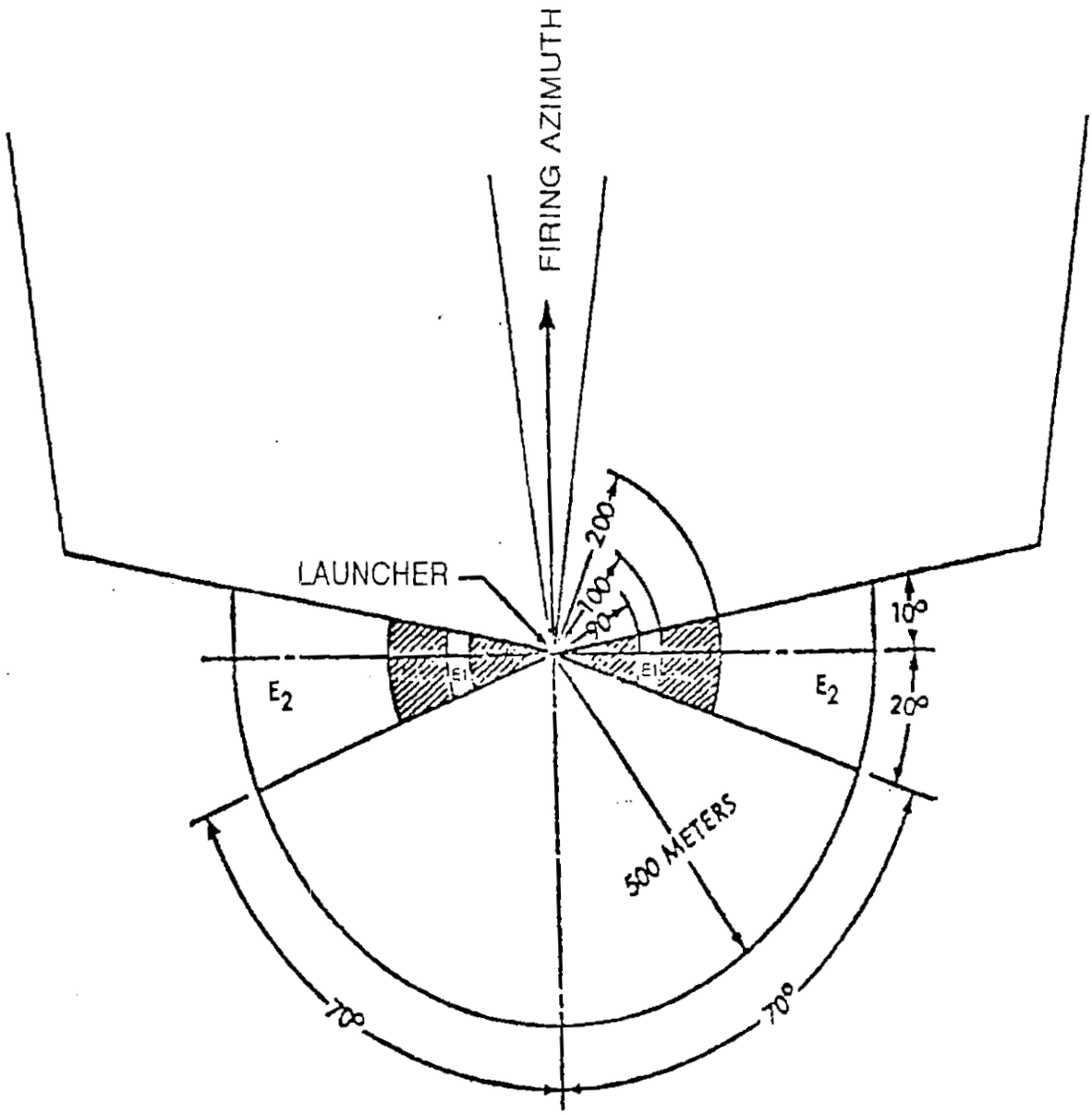
Area B - Maximum Secondary Danger Area
This area is defined as an extension of the impact area and Area A to a distance of 900 m beyond those areas. Area B is considered adequate to contain the forward debris from the impacting missile.

Area C - Launcher Danger Area
This area is defined as that area to the rear and to each side of the launcher which is endangered at the time of firing. The area directly behind the launcher having a radius of 500 m and extending 70^0 to either side of the line of fire is unsafe and considered extremely hazardous for personnel and equipment.

Area E_1 -
This area is defined as a segment of a ring bounded by a 30^0 arc with an inner radius of 90 m and an outer radius of 100 m. A firing pit (foxhole) may be located within Area E_1. When terrain conditions are such that the firing cable can not be extended 90 - 100 m, personnel actually engaged I firing the missile round may be positioned at the point within the 30^0 arc which is not less than 80 m from the launcher. These personnel must be protected by a solid barrier which completely shields their bodies such as an intervening hill mass or sand bags. Under no circumstances will these personnel take cover in a trench or foxhole at a distance less than 90 , unless the trench or foxhole is covered with a solid material capable of reducing the acoustical hazard by reflecting or absorbing the sounds generated by the missile.

Area E_2 -
This area is located to the right and left of the launcher beyond Area E_1. It is defined as a segment of a ring bounded by a 30^0 arc with an inner radius of 200 m and an outer radius of 500 m. Firing crew personnel who are not actually engaged in firing the missile may be positioned within Area E_2. These personnel shall also provide themselves with adequate protection at the time of launch as required in TM 9-1425-485-10-2. Areas outside of Area E_2 are considered safe for unprotected personnel and equipment.


FIRING
AZIMUTH
AREA B
800 M
IMPACT
AREA
8°
8°
800 M
800 M
AREA A
AREA A
DIAGRAM NOT
TO SCALE
LAUNCHER
AREA
C



LAUNCH AREA C DETAILED

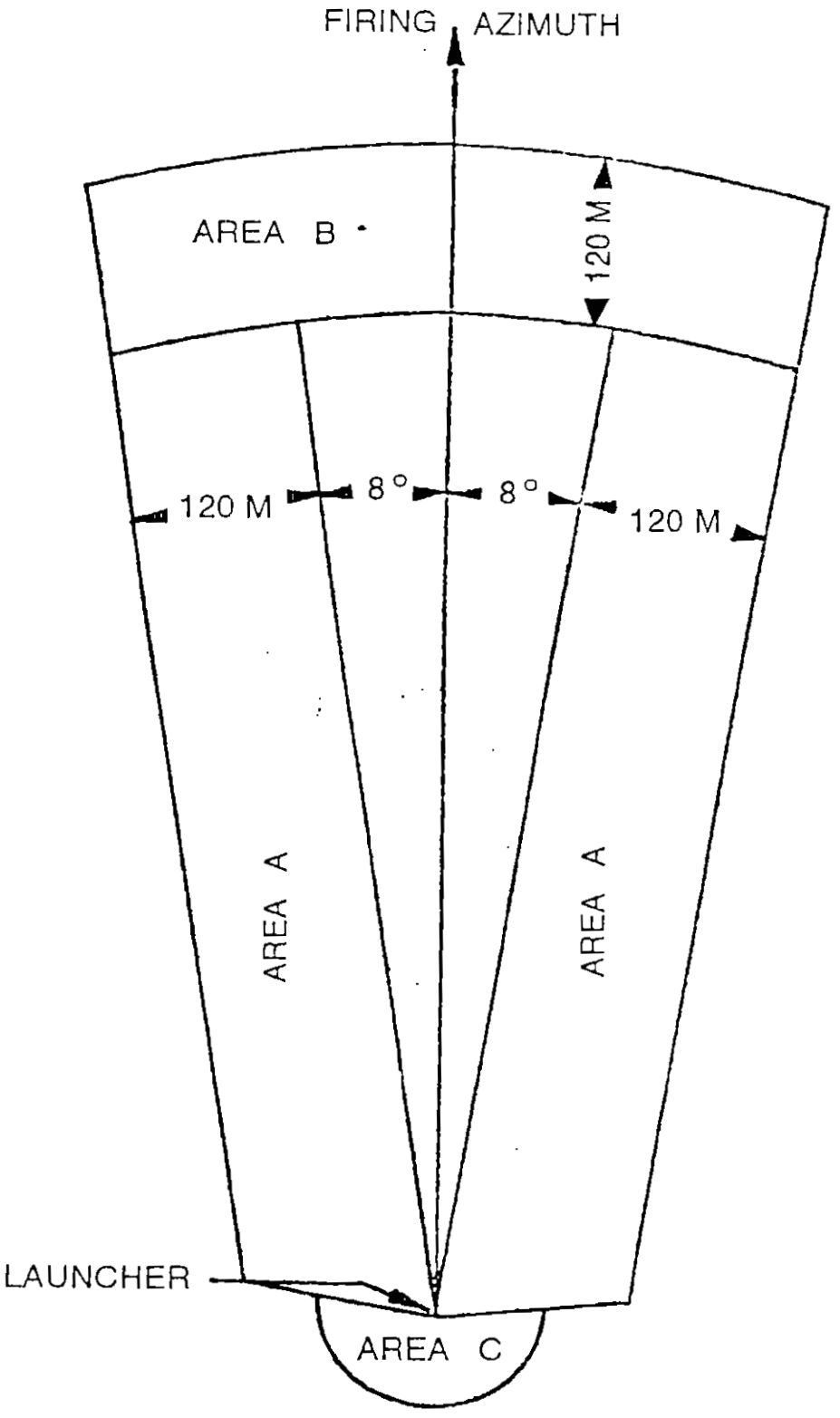


DIAGRAM NOT TO SCALE

Appendix G

Comments received from State and Federal agencies with corresponding response letters

GOVERNOR
Gary E. Johnson

STATE OF NEW MEXICO
DEPARTMENT OF GAME & FISH
Villagra Building
PO Box 25112
Santa Fe, N.M. 87504

DIRECTOR AND SECRETARY
TO THE COMMISSION
Gerald A. Maracchini

March 11, 1996

Commander
U.S. Army White Sands Missile Range
ATTN: Mr. T. A. Ladd, STEWS-DES-E
White Sands Missile Range, New Mexico 88002-5048

Dear Mr. Ladd:

The Department of Game and Fish (Department) has reviewed the Lance Missile Target preliminary draft EA. The Lance missile has been tested at White Sands Missile Range since 1965. This system has been replaced by other missile systems, and the proposed action is to use Lance missiles as targets in other missile tests. The Department anticipates no significant impact to wildlife or its habitat from this project. If you have any questions, please call Bob Wilson at 505/827-7827.

Sincerely,

Jerry A. Maracchini
Director

JAM/BW/ksw

xc: Jennifer Fowler-Propst (Ecological Services Supvsr., USFWS)
Craig Nordyke (Southwest Area Division Chief, NMDGF)
Andrew Sandoval (Cons. Services Division Chief, NMDGF)
Bob Wilson (Habitat Specialist, NMDGF)

State of New Mexico
ENVIRONMENT DEPARTMENT
Harold Runnels Building
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-2850

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

March 19, 1996

Commander
U.S. Army White Sands Missile Range
ATTN: STEWS-DES-E
White Sands Missile Range
New Mexico 88002-5048

Dear Commander:

RE: LANCE MISSILE TARGET PRELIMINARY DRAFT ENVIRONMENTAL ASSESSMENT; WHITE SANDS MISSILE RANGE (UNDATED)

The following provides New Mexico Environment Department (NMED) staff comments concerning the referenced Preliminary Draft Environmental Assessment (PDEA). The review focuses on surface water quality impacts.

The proposed project involves U.S. Army use of surplus LANCE missiles for tracking and interception testing. The testing would occur at existing launch and impact areas located in the Tularosa and Jornada del Muerto basins on the White Sands Missile Range (WSMR). Within these areas, exact launch and impact sites presently are unknown. Launch areas generally are regraded and

cleared of vegetation, and impact areas currently "are maintained in nearly bare ground...conditions." The project would not involve new construction or use of other launch or impact areas without completion of a Record of Environmental Consideration.

The Jornada del Muerto basin has no perennial surface waters or drainage outlet. The Tularosa basin has two perennial water bodies (Lake Lucero and Big Salt Lake), one perennial stream (Salt Creek, which drains to Big Salt Lake), and two known springs (presumably associated with aquifers originating in the surrounding mountains). Both basins feature ephemeral drainages and playas. The local climate is characterized by short, intense (summer/winter) storms. Surface waters, as well as treated water from the WSMR water treatment plant, recharge local aquifers. The rates of aquifer recharge and discharge are low. At places, the depth to groundwater is less than six meters. Ground and surface waters generally are of poor quality with high concentrations of dissolved solids.

For interception missions, LANCE impacts would consist of missile pieces scattered over a large area. Following testing, selected missile debris that is visible from a helicopter would be recovered (disposal was not described in the PDEA).

Tracking missions would involve monolithically impacting missiles. These would result in craters a few meters wide and deep, potentially featuring residual liquid propellants, burned vegetation, and soil erosion. Upon impact, the missile's fuel tanks would rupture. The missile would come to rest about 5m below the preexisting grade. Following testing, the impact crater would be partially backfilled with a thin layer of local native soil (presumably within a few days following impact). After six

months, the crater would be completely backfilled and regraded. The missile would not be recovered.

According to the PDEA, residual liquid propellants potentially delivered to impact areas (tracking missions) include up to 123kg of unsymmetrical dimethylhydrazine (UDMH) and 343kg of inhibiting red fuming nitric acid (IRFNA). The IRFNA reportedly converts spontaneously and completely into nitric acid and oxides of nitrogen. These products are toxic and hazardous. The quantity and fate of the nitric acid were not reported, but nitrite reportedly would dissipate to undetectable concentrations within 30 minutes after impact.

The UDMH would spill into the air and soils. UDMH is a carcinogen and a plant growth control agent. In the air, UDMH reportedly would react with oxygen to produce highly toxic oxides of nitrogen which would dissipate to non-detectable levels within 24 hours. The PDEA incorporates a previous evaluation at WSMR of soil impacts from UDMH. This report, dated November 1991, found no detectible UDMH on surface soils 24 hours after impact (based on laboratory analyses), and no detectible UDMH in subsurface soils at impact craters over six months old (based on soil gas surveys).

Concerning direct impacts to surface waters, the proposed project does not appear to conflict with New Mexico's current laws, statutes, or regulations. However, we are unable to make a more complete determination due to deficiencies in the PDEA. In particular, we strongly recommend that the PDEA be amended to address the following items:

1. The proposed project "probably" would use launch and

impact areas previously used in the LANCE program or areas otherwise "developed". The document should describe any non-probable areas and the nature of the referenced development. Such areas, as well as any potential construction activity, should be specified and described.

2. According to the PDEA, monolithically impacting LANCE would be restricted from "areas of permanent or intermittent water sources." However, the impact areas reportedly feature many ephemeral water courses. The locations and flow characteristics of the permanent and intermittent water sources should be described and mapped relative to the proposed impact and launch sites. NMED staff is concerned that impacts near such water courses might introduce liquid fuel propellants to surface waters, especially if storm events occur soon after impact. Additionally, the PDEA indicates that restricted areas may be affected if missiles are equipped with mechanisms that cause them to "tumble, thus impacting on the surface, or explode on impact resulting in burning of all the propellants." These environmental effects, which may have direct impacts on a surface water body, were not characterized in the report.

3. According to the PDEA, "any fires ignited by LANCE will be handled in accordance with the WSMR fire policy." A copy or detailed description of the policy should be included in the document.

4. The LANCE project could bury significant quantities of

UDMH several meters into the subsurface. The referenced report of UDMH attenuation in subsurface soils was based on soil gas surveys using field instruments. The reported detection limits were not documented or confirmed. The sampling depth (about six feet) may not represent the zone of highest expected contamination. NMED staff believe that UDMH has a low volatility and a potentially high solubility in water. Even in highly conductive soils using the proposed backfilling procedures, significant concentrations of UDMH may persist longer than suggested in this report. We recommend reevaluation of monolithic LANCE impacts using appropriate subsurface soil sampling and laboratory analyses. Such findings may provide more reliable predictions of UDMH attenuation or indicate that UDMH has leached downward rather than dissipated to the atmosphere.

5. According to the PDEA, "recovery operations will involve air support and minimal off-road travel...." The environmental assessment should describe expected significant off-road activities, including the methods and equipment to backfill the large impact craters. In that regard, the following PDEA statement appears to be inconsistent with the rest of the project description: "All proposed ...impact sites for the LANCE project are accessible via paved and/or improved roads. Therefore, the project will not accelerate the natural rate of erosion due to off-road travel."

6. The environmental assessment should provide more information than that contained in the PDEA on the

relative value of surface water resources within the project area to existing wildlife and biotic communities. Cumulative impacts of these and the other topics were, in general, not addressed in the PDEA.

We appreciate the opportunity to review this document. Please let me know if you have any questions.

Sincerely,

Gedi Cibas, Ph.D.
Environmental Impact Review Coordinator

NMED File No. 976ER

May 30, 1996

NEPA Coordinator (Karen Hay)
U.S. Army White Sands Missile Range
ATTN: STEWS - DES - E
White Sands Missile Range
New Mexico 88002

RE: LANCE MISSILE TARGET PRELIMINARY DRAFT ENVIRONMENTAL ASSESSMENT

Dear Karen Hay,

This letter is to inform you of the changes which were made to the LANCE Missile Target Environmental Assessment in response to the comments made by the State of New Mexico Environment Department. A copy of their letter is provided for reference.

PAGE 2, paragraph 3:
Disposal of helicopter and missile debris is described on page 13 of the document. Basically, the debris will be collected, analyzed, and then disposed of as hazardous material.

PAGE 3, response 1:
The impact areas are the primary concern for this missile, due to the missile propellant. Potential impact areas have been limited to those areas without permanent or intermittent surface water. In a few of these impact areas, the depth to ground water is unknown, but believed to be shallow (Pup, Rhodes, Denver, and ABC-1 WITs). Typically used launch areas are established locations consisting of berms, cleared areas, and power (either firm power or designated areas for generators).

PAGE 4, response 2:
A paragraph was added to Section 3.2.1 to address potential impacts to the surface water. The paragraph is provided:

"The restrictions placed on monolithic impacts will also reduce the potential for impacting surface waters. Residual fuel which may be present in a missile which was equipped to tumble and impact on the surface will not pose a substantial threat to the environment. The fuel tanks will likely rupture upon impact and the fuels will continue to mix releasing emissions into the atmosphere which will readily dissipate. If propellants are not able to mix, then the UDMH will react with the air producing gases. IRFNA will react with most substances releasing gases and excessive heat. Gases produced by both propellants are nitrous oxides which are toxic in concentration, but will readily dissipate into the atmosphere."

PAGE 4, response 3:
WSMR does not currently have a document stating the fire policy, however, one is in the process of being reviewed. Presently, the fire policy is if a project starts a fire, then it will be extinguished in an expedient manner. Section 3.1 was edited to clearly state this policy.

"There is potential for fires to occur as a result of debris pieces landing while still burning. However, fuel loads capable of carrying a large fire on the Tularosa Basin floor are fairly limited. The area south of Highway 70 is predominately mesquite coppice dunes with little understory to carry a fire. The WSMR fire chief will be notified prior to any testing, in order to have adequate fire support "on call". Any fires ignited by LANCE will be immediately extinguished."

PAGE 4, response 4:
The concern regarding residual propellant being buried in the ground by monolithic impacts was addressed

by restricting the use of monolithic impacts from areas where residual fuels could cause a serious problem. No monolithic impacts will occur in areas with permanent or intermittent surface water or areas where the depth to ground water is unknown, but believed to be shallow (i.e. Pup, Denver, Rhodes, and ABC-1 WITs).

PAGE 5, response 5:
Craters formed by monolithic impacts of a LANCE missile will typically be backfilled with a backhoe or an armor plated grader. The soil which is required to fill the hole is obtained from the ejected material from the impact of the LANCE missile. If the ejected material is not sufficient, then additional soil is obtained from various mounds within the WITs. The following statements were added to the Executive Summary and section 1.9.

"Equipment used to fill the crater is generally a backhoe or armor plated grader. Soil which was forced out of the ground upon impact is used to fill the hole. If additional soil is required it is obtained from mounds located within the WIT."

Additionally, in section 3.4.2 the paragraph referenced in this response was changed to read:

"All proposed launch and impact sites for the LANCE project are accessible via paved and/or improved roads. However, recovery activities may require off road travel. This activity will be organized to limit the number of vehicles and the most direct route will be used for all travel to and from the site.

PAGE 5, response 6:
The LANCE missile has been restricted from using areas in which there is permanent or intermittent surface water. Therefore, there will be no impact to surface water and in turn no impact to the wildlife which utilize the surface water.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office
2105 Osuna NE
Albuquerque, New Mexico 87113
Phone: (505) 761-4525 Fax: (505) 761-4542

April 19, 1996

Cons. #2-22-96-I-223

Mr. Thomas A. Ladd
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico 88002-5048

Dear Mr. Ladd:

Thank you for the opportunity to review the LANCE Missile Target Preliminary Draft Environmental Assessment (EA) dated February 21, 1996. Approximately, 120 LANCE missiles remain stockpiled on White Sands Missile Range (WSMR). The trajectory of the LANCE missile is similar to that of missiles from less developed countries. As a consequence, the LANCE missiles will be used as realistic targets for other air defense missiles. After reviewing the EA, the U.S. Fish and Wildlife Service (Service) offers the following comments for your consideration.

1. Section 2.9 Affected Environment. Threatened, Endangered and Sensitive Species. In this section, and throughout the document, reference is made to "listed species" as including category 1 and 2 candidate species. This terminology is inaccurate as these species are candidates for listing. Please note that according to CFR 50 Part 17 (February 28, 1996), there are no longer category 1 and 2 candidate species. Category 1 candidates are now called Candidates and category 2 are called Species of Concern. The EA should be revised to reflect this change.

With respect to the stability of White Sands pupfish populations, the Mound Springs population is not secure. A disease event occurring in 1995 dramatically reduced their numbers in both ponds.

2. Section 3.1 Environmental Consequences. Intercept Mission. The citation (Thurow, Warren, and Carlson 1993) should read (Thurow et al. 1993).

3. Section 3.2.1 Environmental Consequences. Water Quality and Supply. The EA states that areas with a water table less than 30 meters from the earth's surface are considered as hydrologically sensitive. It also states that these sensitive areas will not be subjected to monolithic impacts. The EA is not explicit if the depth to water table at Rhodes and ABC-1 WITs meet this criterion.

24 APR 1996
DES

4. Section 3.3.2 Environmental Consequences. Noise. A discussion is given for the effects of loud noise on certain animal species. However, there is no decibel level given for the LANCE missile. The EA should report this value to help in evaluation of the effects of noise on wildlife.

The EA states that the responses of wildlife to noise are temporary. A flight or fright response may be a temporary reaction to noise. However, there may be consequences of a permanent nature resulting from a response to noise. While the adults are away from the nest mortality of young birds or eggs may occur without thermal regulation, by desiccation or predation. Noise may also startle adult birds causing them to break their eggs or roll them from the nest. They may also trample young birds. Fledglings may leave the nest prematurely, exposing them to adverse weather, predation or injury. Frequent noise may weaken adult birds by forcing them to spend more time defending nest sites and less time foraging, subsequently affecting the health of attendant offspring. With persistent disturbance, adults may abandon their nest entirely.

Recent studies on the effects of human disturbance on raptors showed birds make shifts in home range and increase home range size (Anderson et al. 1986). Fernandez and Azkona (1993) found a stress increase in chicks, as determined from blood urea concentrations, and an increase in reproductive effort by adults.

The Service recommends that WSMR survey launch and impact sites used for the LANCE missile program for raptors, including the northern aplomado falcon. If raptors are found, buffer zones should be established for their protection. Buffer zones have been recommended for a variety of human uses near golden eagle nests. Several references recommend no activities occur within 2 miles of raptor nests during the nesting season (Jacobson 1974, Blood and Chutter 1978, Northern Pipeline Agency 1978). The Yukon Wildlife Department recommends a distance of 2 miles between pipelines and nests (Mossop and Milligan 1977). Kluane National Park, Canada, does not allow heavy equipment within 2.5 miles of a golden eagle nest (Theberge and Gauthier 1978). Several references refer to buffer zones to protect raptors ranging from 1,300 to 5,250 feet (Ramakka 1986), and 980 feet to 5 miles (Nelson 1979). Most of the literature that was reviewed suggested a buffer zone around 3,000 feet to prevent disturbance.

5. Section 3.3.5 Environmental Consequences. Threatened, Endangered and Sensitive Species. Scheer's pincushion cactus and grama grass cactus are not federally listed as threatened, endangered or candidates. Nor are they species of concern. However, we do encourage WSMR to perform surveys for sensitive species if sites not currently used as impact areas are considered for the LANCE Missile Target Program.

6. Section 4.2 Mitigation Measures. LANCE Recovery. With respect to backfill, the EA is not clear as to the source of fill material to be used. If soil will be obtained from on-site, will it be tested for unsymmetrical dimethylhydrazine?

Measures should be developed to ensure that contaminated soil will not be used to backfill craters from monolithic impacts.

If we can be of further assistance, please call Mr. Craig L. Springer of my staff at (505) 761-4525.

Sincerely,

Jennifer Fowler-Propst
Field Supervisor

cc:
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Director, New Mexico Energy, Minerals and Natural Resources Department, Forestry and Resources Conservation Division, Santa Fe, New Mexico
Geographic Manager, New Mexico Ecosystems, U.S. Fish and Wildlife Service, Albuquerque, New Mexico

Literature Cited

Anderson, D., O. Rongdstad and W. Mytton. 1986. Home range changes in breeding raptors exposed to increased human activity levels in southeastern Colorado. In: R. L. Glinski et al., eds. Proceedings of the southwest raptor management symposium and workshop. National Wildlife Federation Scientific and Technical Series No. 11. Washington D.C. 397pp.

Blood D., and M. Chutter. 1978. 1978 raptor nesting survey for Shakwak highway improvement project (Public Works Canada, British Columbia and Yukon). Report prepared for Thurber Consultants Ltd., Victoria, British Columbia, Canada. 70 pp.

Fernandez, C. and P. Azkona. 1993. Human disturbance affects parental care of marsh harriers and nutritional status of nestlings. J. Wildl. Manage. 57(3):602-608

Jacobson, J. 1974. Birds, Chapter 6. pp. 120-176. In: Environmental impact statement of the portion of the Mackenzie gas pipeline from Alaska to Alberta, Vol. IV, Research Reports. Environment Protection Board. Winnipeg, Ontario, Canada.

Mossop, D. and P. Milligan. 1977. Alcan pipeline proposal in relation to non-migratory birds. pp. 97-112 In: Alaska highway gas pipeline project: environmental concerns and recommendations of the Yukon Wildlife Branch. Whitehorse, Yukon, Canada.

Nelson, R. 1979. An assessment of the impact of northern activities upon certain raptors. Prepared for Foothills Pipe Lines (Yukon) Ltd. Calgary, Alberta, Canada. 93 pp.

Northern Pipeline Agency. 1978. Initial draft. Environmental requirements for the pipeline for the transmission of natural gas from Alaska across Canada. Ottawa, Ontario, Canada.

Ramakka, J. 1986. Impacts and mitigation of mineral development on raptors in the southwest. pp. 335-340. In: R. L. Glinski et al., eds. Proceedings of the southwest raptor management symposium and workshop. National Wildlife Federation Scientific and Technical Series No. 11. Washington, D.C. 397pp.

Theberge J. and D. Gauthier. 1978. Inventory of raptors in the Slims River drainage, Kluane National Park. Reports to Parks Canada, Prairie Region. 54 pp.

`1 30, 1996

.EPA Coordinator (Karen Hay)
U.S. Army White Sands Missile Range
ATTN: STEWS - DES - E
White Sands Missile Range
New Mexico 88002

RE: LANCE MISSILE TARGET PRELIMINARY DRAFT ENVIRONMENTAL ASSESSMENT

Dear Karen Hay,

This letter is to inform you of the changes which were made to the LANCE Missile Target Environmental Assessment in response to the comments made by the United States Fish and Wildlife Service. A copy of their letter is provided for reference.

COMMENT 1:
a) The document was updated with the current terminology "Candidates" and "Species of Concern".

b) A statement was included on page 25 of the document referencing the disease event which took place in 1995 reducing the pupfish populations in both ponds.

COMMENT 2:
The change to the citation was made.

COMMENT 3:
The depth to ground water at Rhodes and ABC-1 WITs is unknown. Therefore, Rhodes, Denver, and ABC-1 WITs have been restricted from monolithic impacts as a precaution.

COMMENT 4:
The primary concern expressed in this comment is the potential effect of the project on nesting raptors in close proximity to a launch or impact area. The project has committed to conducting an annual survey around launch and impact locations for raptor nests. A brief description of the survey methodology was added to Section 3.3.2 as well as stating the requirement for the survey in Section 4.1 of the document. The added text to each section is provided.

Section 3.3.2
"The Lance project will initiate an annual survey to identify raptor nests in proposed launch and impact areas. Surveys will consist of inspecting a 1km radius around the center of proposed launch and impact areas during each breeding/nesting season. If an active nest is detected, DES-E will be consulted immediately. Information collected during these surveys, combined with data collected during previous aplomado falcon surveys, may then be used to developing a database which could aid in identifying low tolerance species and frequently used nesting habitat within WSMR. This, in turn, could minimize future impacts on nesting raptors. Although delaying test activities would be beneficial to nesting individuals, if long term protection is the goal, observations should be made to identify the response of raptors to various acoustical disturbances within the immediate area."

Section 4.1
"Launch and impact areas will be surveyed during the nesting season to identify any active raptor nests within close proximity. If nests are located, then WSMR DES-E will be consulted to determine the appropriate action."

COMMENT 5:
The listed plant species section was updated with the latest listing information. Scheer's pincushion cactus and grama grass cactus were removed from discussion as they are not listed by state or federal agencies.

COMMENT 6:
Craters formed by monolithic impacts of a LANCE missile will typically be backfilled with a backhoe or an armor plated grader. The soil which is required to fill the hole is obtained from the ejected material from the impact of the LANCE missile. If the ejected material is not sufficient, then additional soil is obtained from various mounds within the WITs. The following statements were added to the Executive Summary and Section 1.9.

"Equipment used to fill the crater is generally a backhoe or armor plated grader. Soil which was forced out of the ground upon impact is used to fill the hole. If additional soil is required it is obtained from mounds located within the WIT."